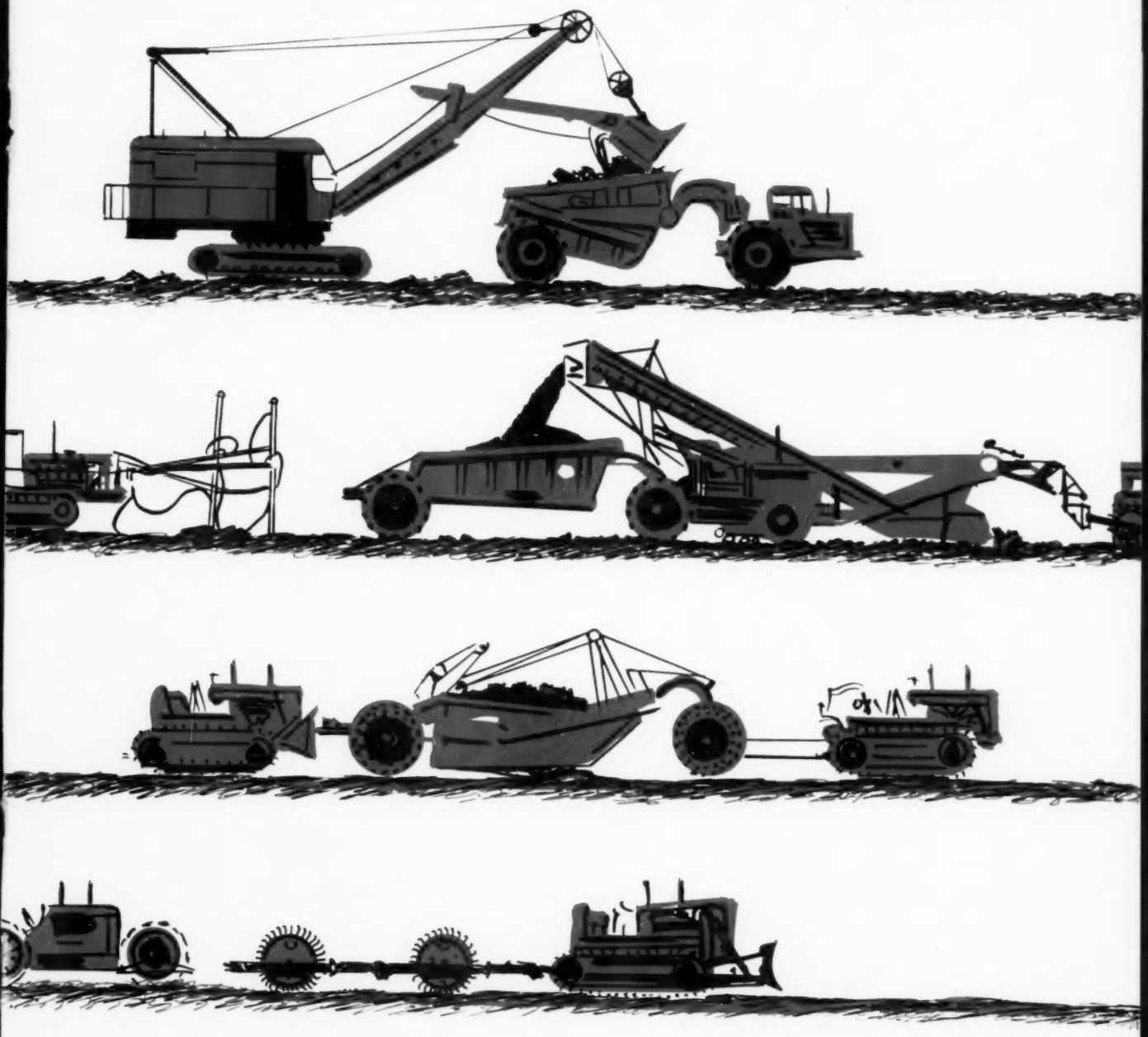
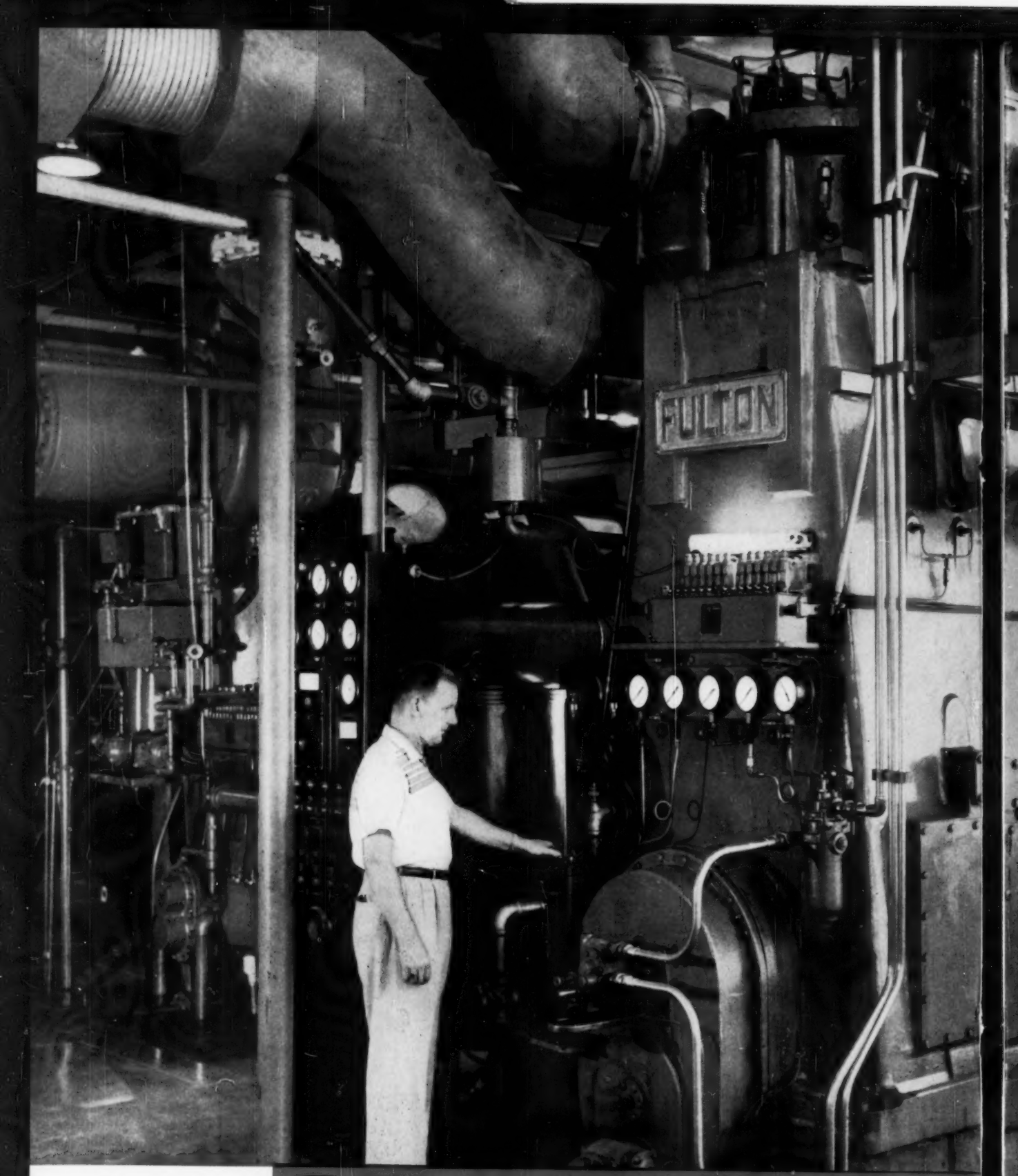
diesel power

February 1957





TUNE IN:
METROPOLITAN
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radio broadcasts
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TEXACO

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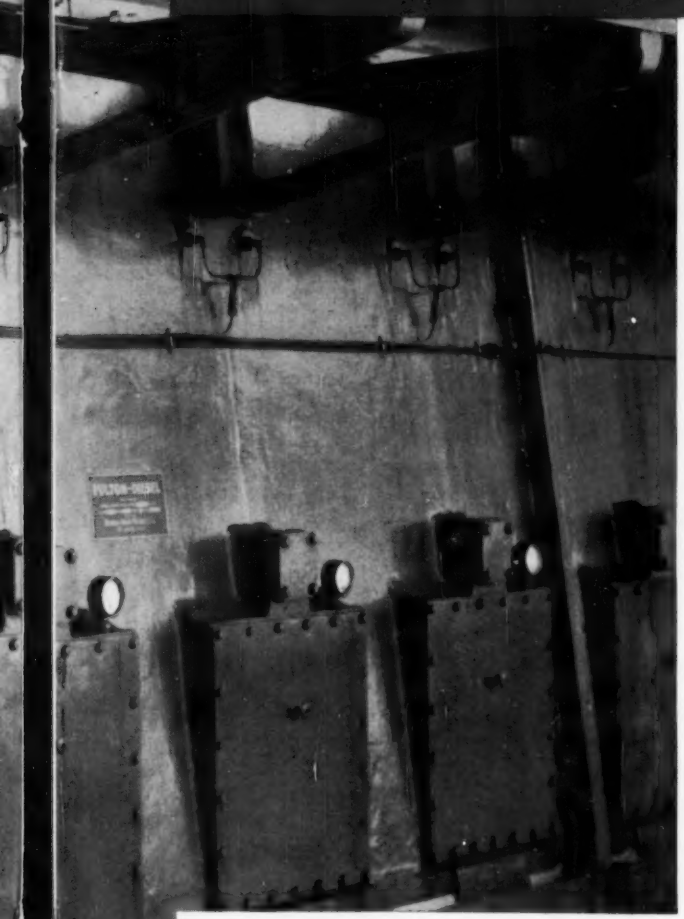
TEXACO

IN 25 YEARS

"no harmful deposits, no stuck rings, minimum wear"



FOR OVER 20 YEARS, MORE STATIONARY DIESEL H.P. IN THE U. S. HAS BEEN LUBRICATED WITH TEXACO THAN WITH ANY OTHER BRAND

This is a report on a mid-western utility plant (name on request) that has been lubricating its diesels with *Texaco Ursa Oil* for a quarter of a century.

Here's what the superintendent said:

> **"We started using *Texaco Ursa Oil* with our first diesel. It gave us such fine lubrication—clean operation, no harmful deposits, no stuck rings, minimum wear—that we naturally chose *Texaco Ursa Oil* for each of the four other engines installed since. We consider this an important factor in keeping maintenance and operating costs at an absolute minimum."**

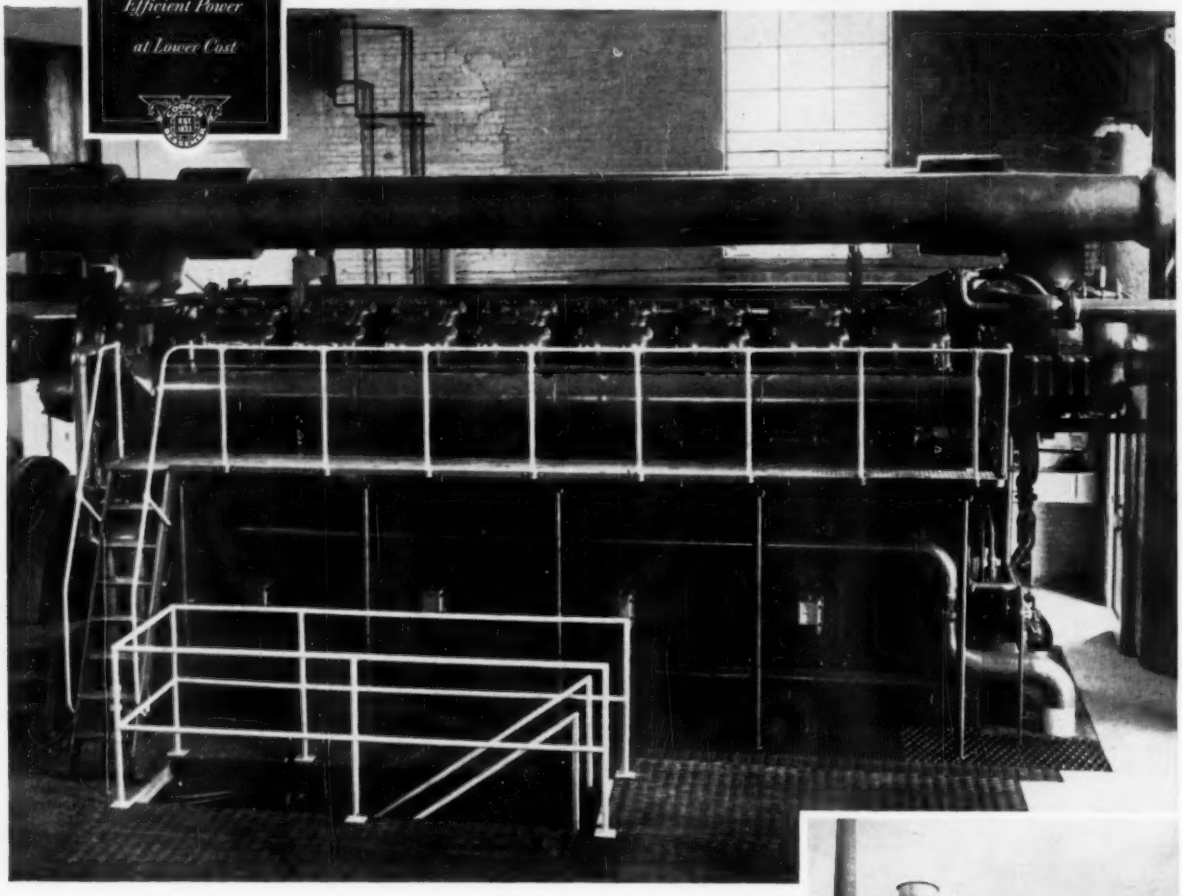
There is a complete line of the famous *Texaco Ursa Oils*. All are refined and processed especially for the lubrication of diesel, gas and dual-fuel engines—to assure *more power* with *less fuel* over *longer periods* between overhauls.

A Texaco Lubrication Engineer will gladly give you the full story. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N.Y.

URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

Another Example of Efficient Power at Lower Cost

There's a lot of dependable horsepower packed in this 16-cylinder turbocharged Cooper-Bessemer LSV Gas-Diesel. In operation at the Princeton, Illinois municipal power plant, this unit delivers 3,600 hp at 327 rpm.



How Cooper-Bessemer Solved A "Growing" Problem at Princeton Municipal

• Faced with growing power demands and insufficient capacity, Princeton, Illinois installed a 3,600 hp Cooper-Bessemer Gas-Diesel engine to boost generating facilities in their municipal power plant.

Selection of this engine was based primarily on three important Cooper-Bessemer advantages. First was extreme flexibility for continued, low-cost power generation. With the supply of natural gas limited during certain months, the engine can easily be switched to straight diesel fuel or any fuel combination as supply dictates.

Compactness of the LSV made it ideally suited for space already available in the Princeton plant . . . no need for additional construction. Finally, the 16-cylinder LSV offered top operating economy with maximum efficiency and minimum maintenance.

This kind of all-around efficiency and economy is ready to meet *your* particular needs, too. For complete information, contact the Cooper-Bessemer office nearest you.

MOUNT VERNON, OHIO
COOPER-BESSEMER
GROVE CITY, PENNA.

New York City • Seattle, Wash. • Bradford, Pa. • Chicago, Ill. Houston, Dallas, Greggton, Pampa and Odessa, Texas Washington, D. C. • Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. • Cooper-Bessemer of Canada Ltd., Edmonton, Alberta—Halifax, Nova Scotia.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

The addition of FOA-2 to diesel fuel minimizes filter-plugging, injector-sticking and other problems caused by sludge.

Diesel fuel problems often solved by Du Pont chemical additives

The formation of deposits or residues in your fuel can cost you money.

Improved usability of a greater variety of stocks, plus economy, are two of the benefits you can obtain with Du Pont Fuel Oil Additive No. 2 (FOA-2) and Du Pont Metal Deactivator (DMD).

Improved characteristics

A growing number of oil companies rely on FOA-2 to impart improved characteristics to a great *variety* of fuels. You, too, can be assured of good results with a wide range of fuel stocks.

Economy

Your maintenance costs go down when you burn fuel protected with either FOA-2 or DMD—or both. FOA-2 relieves filter-plugging and injector-sticking problems because of its outstanding stabilizing and dispersant actions.

DMD retards the formation of troublesome gel accumulations—brought about by the harmful effect of copper or bronze on fuel oil.

If your present fuel—high-grade *or* economy—gives you less than the performance you expect, check to see if the situation could be improved with Du Pont FOA-2 and/or DMD.

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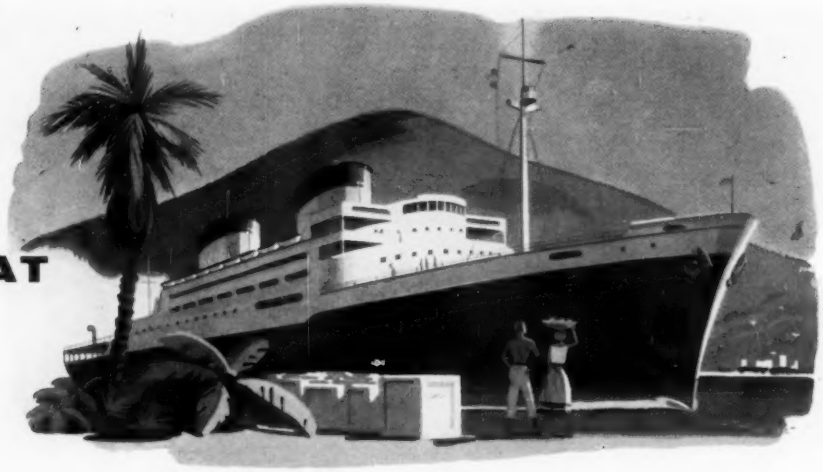

OR ARCTIC COLD

Harrison Heat-Exchangers Keep Temperatures Level!

Harrison goes to any extreme to keep temperatures on the beam . . . to keep temperatures normal under all types of operating conditions! These top-quality heat-exchangers are busy everywhere —on land, on sea, and in the air . . . guarding critical engine temperatures and providing safe, sure performance. They're lightweight and compact, too—designed to save you space and money. That's why Harrison is a leader in its field—that's why so many manufacturers rely on Harrison *exclusively* for dependable, economical heat-transfer equipment. If *you* have a cooling problem, look to Harrison for the answer.

GM GENERAL MOTORS

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORP., LOCKPORT, N. Y.

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diesel power

Established in 1923 **Vol. 35, No. 2** **February, 1957**

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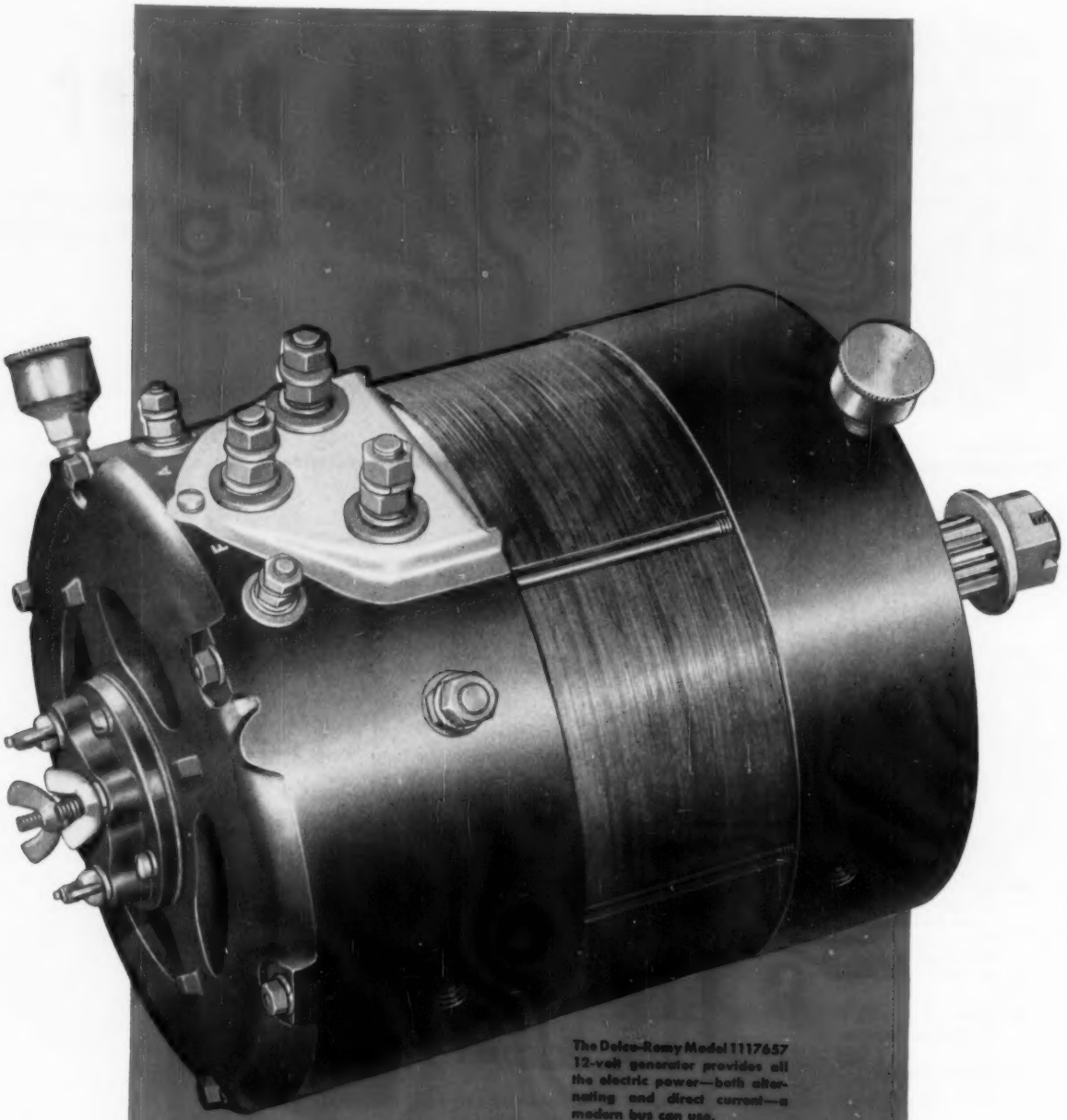
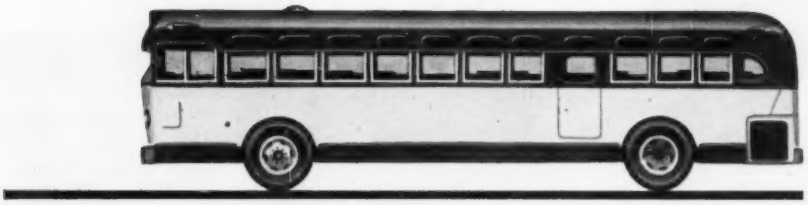


The Delco-Remy Model 1117657 12-volt generator provides all the electric power—both alternating and direct current—a modern bus can use.



ASK FOR DELCO-REMY MODEL 1117657—THE GENERATOR THAT HANDLES THE TOUGH JOBS WITH EASE!

This Delco-Remy 12-volt generator—Model 1117657—is the heart of an A.C.-D.C. charging system designed specifically for buses with continuous and extremely heavy electrical loads. It has a low cut-in speed of about 550 rpm, a curb-idle output of 130 amp., and a maximum output of 180 amp. at approximately 2000 rpm. Physically, it is rugged yet extremely low in weight for such a tremendous output. With its matching regulator and rectifier, Model 1117657 will give you all the power a modern bus can use—alternating current for fluorescent lighting, plenty of direct current for other electrical equipment. Specify Delco-Remy A.C.-D.C. charging systems for your buses. They're typical of Delco-Remy leadership in the automotive electrical field.

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GENERAL MOTORS LEADS THE WAY—STARTING WITH

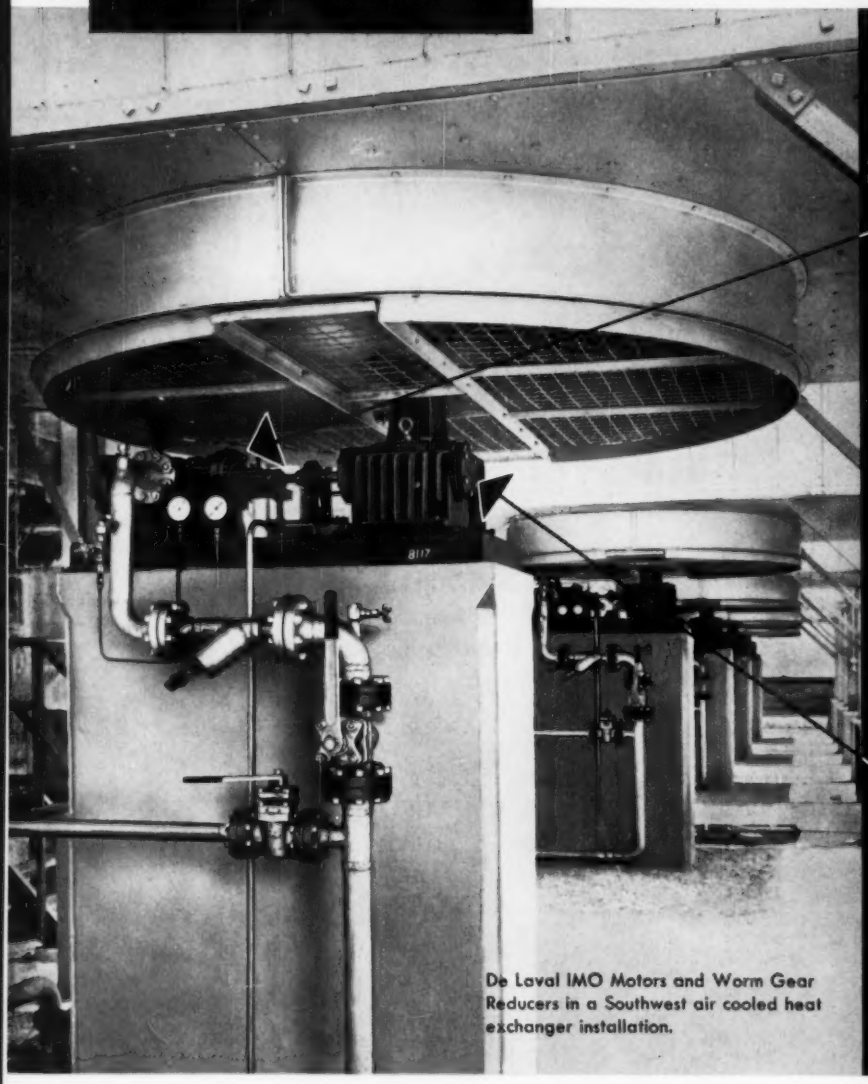
Delco-Remy

ELECTRICAL SYSTEMS

DELCO-REMY • DIVISION OF GENERAL MOTORS • ANDERSON, INDIANA

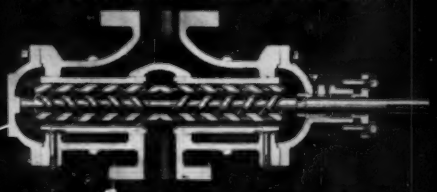
DE LAVAL
HYDRAULIC FAN DRIVES

do dependable, power-saving job in air-cooled cooling towers



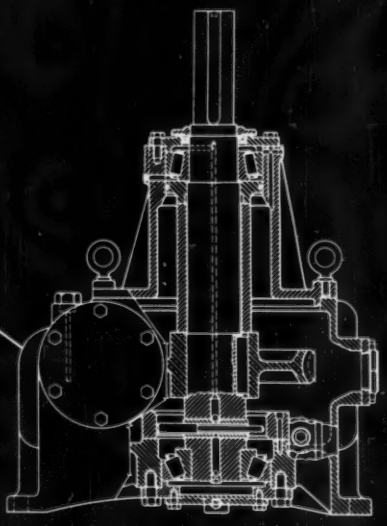
De Laval IMO Motors and Worm Gear Reducers in a Southwest air cooled heat exchanger installation.

De Laval IMO Motors and Pumps



simple, reliable, pulsation-free

De Laval Worm Gear Speed Reducers



ruggedly built for severe service

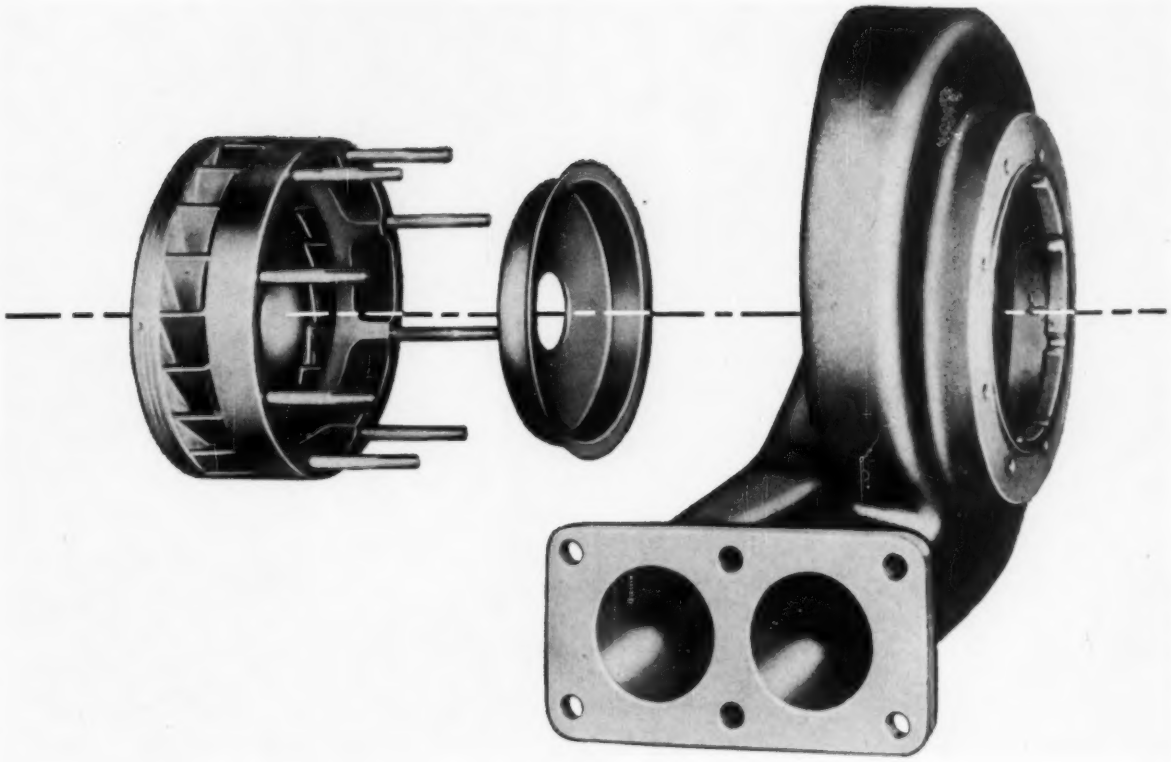
De Laval Hydraulic Fan Drives for air cooled heat exchangers and cooling towers *save power* since the fan operates at full speed only a portion of the time. Furthermore, there is no demand charge on hydraulic power. • Equally important, they provide *accurate, automatic* control of engine jacket water temperature, and also assure *complete operational flexibility*. Due to the simplicity of De Laval IMO motors and pumps as well as the rugged construction of De Laval Worm Gear Reducers, these units stay on the job for years. Both IMO motor and speed reducer are mounted and factory aligned on a single bedplate.

Investigate *all* the advantages of De Laval Hydraulic Fan Drives. Send for your copy of Bulletin 3009 which includes helpful performance data.

DE LAVAL *Hydraulic Fan Drives*

DE LAVAL STEAM TURBINE COMPANY
890 Nottingham Way, Trenton 2, New Jersey

DL370



Hot parts of diesel turbocharger last longer when made of Ni-Resist

Over 15,000,000 diesel horsepower is supercharged by equipment of the Elliott Company, Jeannette, Pa.

Elliott uses Ni-Resist* austenitic iron for the hot spots in turbochargers . . . uses it for exhaust inlet casings and nozzles.

Experience shows that Ni-Resist gives Elliott the stability these parts need at high temperatures because of its resistance to growth and scaling.

Elliott uses type 2 Ni-Resist cast iron to match the coefficient of thermal expansion of the 302 stainless steel nozzle ring blades. Result: blades stay seated firmly in the nozzle ring despite violent temperature changes.

If you're looking for a cast iron with high stability at 1400°F. temperatures, you'll find it in Ni-Resist. This alloy shows 12 times better resistance to growth than plain iron . . . 10 times better scaling resistance.

Other important characteristics of this high nickel cast iron are its good machinability and high resistance to wear in metal to metal service.

Get the facts about Ni-Resist alloy from the Inco booklet, "Engineering Properties and Applications of Ni-Resist." It includes corrosion data on Ni-Resist and cast iron under 400 different corrosive conditions. Along with it you'll get "Buyers Guide for Ni-Resist Castings," a helpful listing of Ni-Resist producers. Just fill out the coupon below.

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The International Nickel Company, Inc.
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Please send me your booklet, "Engineering Properties and Applications of Ni-Resist" and include the "Buyers Guide for Ni-Resist Castings."

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INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N. Y.

CONVEYOR AND SIOUX SPEED VALVE GRINDING!

Pictured above, left, is a scene in the Chesapeake & Ohio Railroad, Huntington, West Virginia, Diesel Locomotive Shop. The operator is using a SIOUX Heavy Duty Portable Driver, and a SIOUX Stone Grinding E.M.D. Liner Head Valve Seats. The SIOUX Driver is lowered from a retractor hanger. Liner Heads are held in shop-made positioners which are moved along the assembly line conveyor.

Diesel Engine manufacturers recommend SIOUX Valve Seat Grinding Equipment. Factory approved sets include Allis-Chalmers, American-Locomotive, Baldwin Locomotive, Case Tractor, Cooper Bessemer, General Motors Corp., Hercules Engines, International Harvester Trucks and Tractors, John Deere Tractor, Massey-Harris Tractor, Minneapolis-Moline Tractor, National Supply, Oliver Tractors, Onan Engines, Reo Motors, White Motor Trucks.

The new Spline Drive now being supplied, gives from ten to twenty times the life of the hex drive, and is more accurate.

A SIOUX 682L Valve Face Grinding Machine is shown above, right, in operation in the Chesapeake & Ohio Railroad, Huntington, West Virginia, Diesel Shop.

More SIOUX *Valve Grinding Machines are in use than all other kinds combined.* No other machine compares with the SIOUX 682L in ruggedness, precision, and ability to do the big jobs.

Your nearest SIOUX Distributor is listed in the yellow pages under "Portable Electric Tools".

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ALBERTSON & CO., INC.

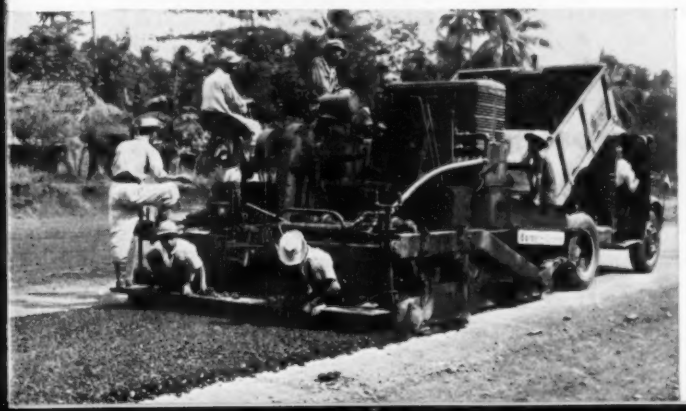
SIOUX CITY, IOWA, U.S.A.

ELECTRIC DRILLS • SANDERS • GRINDERS • IMPACT WRENCHES
POLISHERS • PORTABLE SAWS • FLEXIBLE SHAFTS • VALVE FACE GRINDING MACHINES • ABRASIVE DISCS

An International UD-18A powers the cyclone dust collector and a UD-1091 operates the dryer in this Barber-Greene Model 848 bituminous plant owned by Hallet Construction Company, Ames, Iowa.

Rock County, Wisconsin, is now in the paving business with this Barber-Greene Model 848 Travel plant. Towing loader uses an International UD-350 and the mixer uses a UD-18A.

100% International power units and trucks is the rule for Hazelmore Bituminous Co., Fairmont, Minn. Their Barber-Greene Model 848 continuous-mix plant is powered by a UD-18A and a UD-24.



Even in Djakarta, Indonesia, the preference is for International power units. Here a UD-6 powers the government-owned Barber-Greene Model 879-A Finisher.

...WHY specify International Power Units for bituminous plants?

These owners of Barber-Greene bituminous plants and pavers would give you these hard dollar reasons: Internationals have more features that pay off in lower production costs—and unsurpassed parts and service support for your convenience.

Economical? You bet, with a clean-burning exclusive injection and combustion system...a 45° angle of injection...new open-face single-orifice nozzles that give thousands of hours of coke-free operation.

Weather-proof? Definitely, with seconds-fast all-weather gasoline-conversion starting...full-flow filtering of all fuel, lube oil and air.

Dependable? Sure thing, with such features as tocco hardened crankshaft journals, precision insert bearings and replaceable hardened sleeves.

Heavy-duty? That's the only type of engine International has built in 55 years. And the positive-type valve rotators that make valve grinding such an infrequent need is just one of the famous IH long life features that have helped sell more than 400,000 diesels.

For more information, just see your easy-to-locate International Power Unit Distributor or Dealer. He'll provide proof you can specify and get an adaptable International power unit that's exactly right for your new or used machine. So be sure of profitable power for a long time to come by specifying Internationals for all of your driven machines.

INTERNATIONAL®
CONSTRUCTION EQUIPMENT

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A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Side-Boom Tractors... Self-Propelled Scrapers and Bottom-Dumps... Crawler and Rubber-Tired Loaders... Off-Highway Trucks... Diesel and Carbureted Engines... Motor Trucks.

advanced design in turbochargers means... air-cooling!

AiResearch turbochargers possess this all-important characteristic

There's little quarrel in the diesel industry about the air-cooling principle being highly-desirable in a turbocharger. It eliminates the need for extra plumbing on installation, puts no additional burden on an engine's cooling system and makes for a lighter, smaller unit in relation to output.

AiResearch turbochargers now available have been designed on this principle — which promises to be universal in the future. In addition, our units increase power up to 100% depending on design and application of your engine, cut fuel costs, reduce noise and decrease or eliminate smoking. The removable rotating assembly makes them easier to maintain than other turbochargers.

We invite your inquiry on how you can improve the performance of your diesels by the application of our turbochargers.

BASIC SPECIFICATIONS FOR AIRESEARCH TURBOCHARGERS

MODEL	T-10	T-14	T-15	T-30-2	T-30-6
Diameter — in. nom.	9	11.5	15.25	15.25	16
Length — in.	9	14.12	16.75	17.25	21.75
Weight — lb.	40	95	125	135	195
Output — lb/min. (Standard Conditions)	25-40	35-65	35-65	70-95	115-175

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 South Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS

TURBINE AND DIESEL LUBRICANT GUIDE

CITIES SERVICE TURBINE OILS

Manufactured from the highest quality, solvent refined stocks, these oils have high viscosity index, excellent heat resistance. They are chemically fortified to prevent oxidation, rust, and foaming, permit smoother operation.

PACEMAKER 150-T

Recommended for pressure-circulation systems of direct-connected steam turbines, and for the bearings of turbo-generators where pressure-circulation of the oil is employed.

PACEMAKER 300-T

For use in the lubrication of steam turbines with single reduction gear units. Also for the lubrication of high-speed, ring-oiled, auxiliary turbines, where operating temperatures are not above 200°F.

PACEMAKER 400-T

Recommended for the lubrication of propulsion turbine units on naval and commercial vessels, in pressure-circulation systems.

PACEMAKER 500-T

Suitable for the lubrication of ring-oiled bearings of auxiliary turbines where operating conditions require an oil of heavier body than Pacemaker 300-T. Also recommended for use in separately lubricated turbine gear reduction units.

PACEMAKER 750-T

Recommended for the lubrication of high-speed, ring-oiled, auxiliary turbines, where operating temperatures are in excess of 200°F., and use of a heavier bodied oil is required.

CITIES SERVICE DIESEL OILS

Made in the world's most modern lubricating oil refinery at Lake Charles, Louisiana, Cities Service Diesel Oils are blended from highest quality, high V.I. mineral oils and fortified with specially developed additives. There's a Cities Service Diesel Oil tailored for top performance in every type of diesel operation.

D-C 300 SERIES

These oils are designed to fully conform to Military Specification MIL-L-2104A. Made from the finest base oils, they are strongly fortified against oxidation and corrosion. They have the necessary detergent-dispersant properties to insure superior lubrication performance in high speed Diesel engines operating under heavy duty service.

Recommended for service DG under A.P.I. classification system.

D-C 100 SERIES

These oils are designed to conform to U. S. Army Specification 2-104B (Supplemental List 1). They are also known as Superior Lubricants Series 1 and are intended for more severe service than the D-C 300 Series Oils. Particularly recommended for the lubrication of medium and high-speed Diesel engines using lower quality fuels.

Recommended for service DM under A.P.I. classification system.

D-C 500 SERIES

These oils meet the requirements of The Caterpillar Tractor Company for a "Superior Lubricant (Series 3)". They have the highest level of detergent-dispersant action with maximum oxidation and corrosion protection to assure reliable operation of Diesel engines under most severe service conditions or where low quality fuels of very high sulphur content are used.

Recommended for service DS under A.P.I. classification system.

PACEMAKER SERIES

The new Pacemaker line of Diesel engine oils is made from the same high quality base oils as are the Pacemaker T Series, and contains similar additives, but in lesser amounts. These oils are adaptable for use in many low and medium speed stationary engines operating under conditions which would not require the use of heavier fortified oils, such as the Pacemaker T Oils.

PACEMAKER T SERIES

These are medium duty, high grade, high V.I. oils fortified against oxidation, rust and foam. Admirably suited for slow and medium speed engines employing the dry sump system of lubrication and operating under conditions where the service is not severe enough to benefit from a full heavy duty oil.

NEPTUNE 9000 SERIES

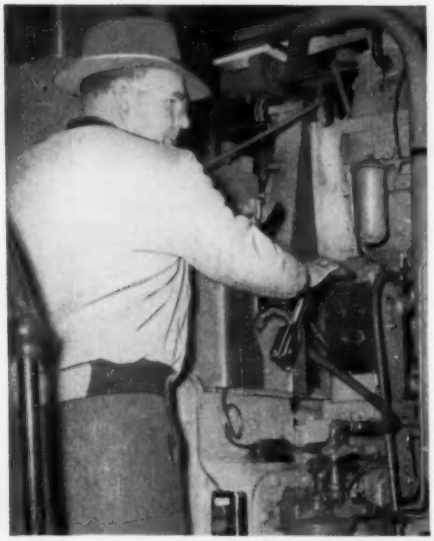
Designed specifically for lubrication of marine-type Diesel engines, both military and commercial.

Neptune 9000 Series Oils are made from high quality, high V.I. solvent refined stocks and are strongly fortified against oxidation and corrosion. They are specially inhibited against silver alloy bearing corrosion and have the necessary detergent-dispersant properties to give maximum performance under severe operating conditions.

These oils conform to the requirements of Military Specification MIL-L-900 C (SHIPS) for marine Diesel engine lubrication.

CITIES SERVICE

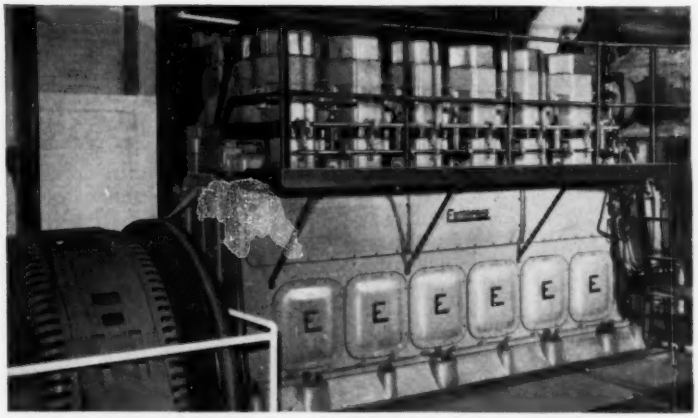
QUALITY PETROLEUM PRODUCTS



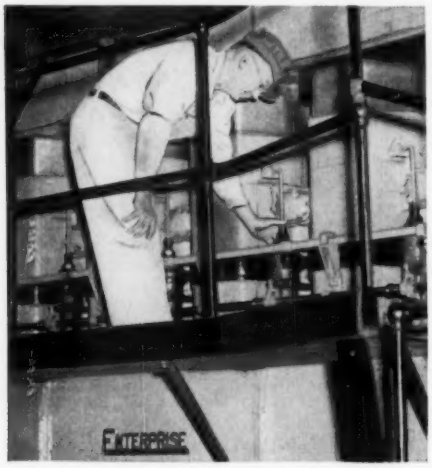
"We Added an Enterprise Dual Fuel Engine—Now Save $700 a Month on Fuel and Lube Oil Alone!"

Says JAMES J. LESLIE, Superintendent,
Paulding Light & Water Works, Ohio

At the Dual Fuel "Select-O-Matic"® control, "Pete" Leslie demonstrates ease of change-over from dual fuel to straight diesel operation of 1000 kw Enterprise. Engine never drops a cycle changing either way!



The 1400 HP Enterprise has logged over 21,000 hours without any major maintenance. Valves have not been ground, rings never replaced. No overhaul will be planned until there is some evidence of work required!



Chief Engineer Perry "Jack" Jackson on routine inspection of Enterprise Turbocharged Model DGSQ-316. After two and one half years on local natural gas and diesel fuel oil No. 2, firing pressures and exhaust temperatures have remained exceptionally even.

"Our Enterprise is one of four diesels in the plant, and it carries almost all of the load, 24 hours a day. That's because it's the most economical and dependable engine we've ever operated. Whether it's on dual fuel in normal periods, or on straight diesel during light loads of 300 kw or less, this engine performs very, very well. We like the safe margin of reserve it gives us, too—even during peaking periods."

Mr. "Pete" Leslie points out what a really profitable power plant means to the city of Paulding. Electric rates have been reduced substantially. Street lighting, power for the City Hall, and a beautiful municipal swimming pool have been provided at no cost to taxpayers.

This is another example of how cities and towns throughout America benefit from dependable Enterprise Engines. Write us today for full information, or call your nearest Enterprise office. Models from 73 to 7703 HP in diesel, dual fuel, tri-fuel and spark ignited gas engines.

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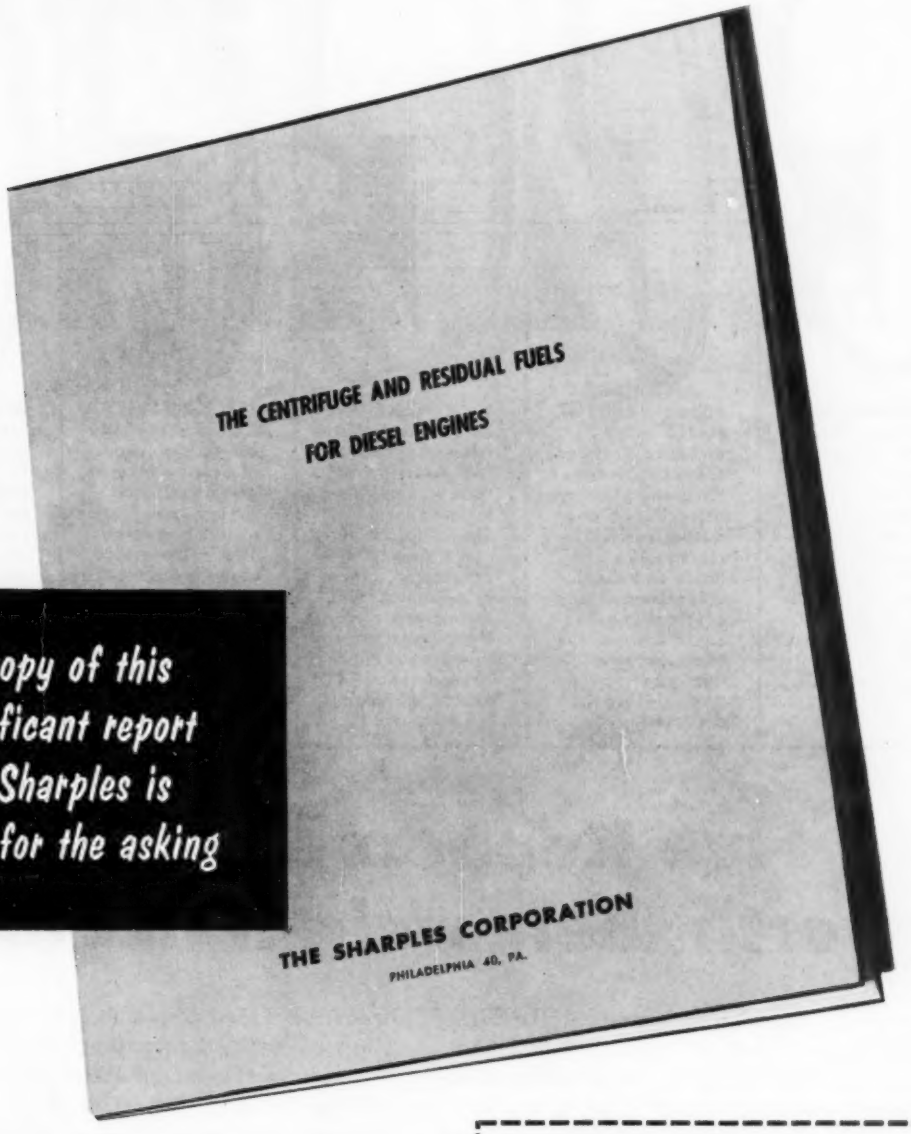
The Title Speaks for Itself...



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COMPRESSION RING . . . 1-piece, quick-seating. Maximum strength. Turned finish on outside diameter lets ring conform readily to the cylinder bore. The chemically treated surfaces aid rapid seating, no scuffing or scoring during run-in. ½" to 120" diameters.

POROUS CHROME PLATED RING . . . exclusive Van der Horst process. Shallow porosity on cylinder contacting surface facilitates break-in, holds and distributes oil during this critical period. Lasts four times longer, cuts cylinder wear up to 75%. ½" to 42" diameters.

CONFORMABLE OIL RING . . . maintains constant pressure for positive oil control. Conforms to meet cylinder distortion; flexible cast iron member, pressed outward by abutment type spring exerts uniform radial pressure around entire circumference. 4" to 25" diameters, ¼" min. width.

KOPPERS SEAL RING . . . has one or two projecting bands of bearing bronze inserted in contacting face. Very quick-seating. Tends to prevent blow-by in new or worn cylinders. The burnishing action of bronze on cylinder walls decreases scuffing and wear. 2" to 30" diameters.

GROOVED OIL CUTTER RING...valuable where oil control is a major problem. Two bevels for riding over oil on up-stroke, two scraping edges for removing excess oil from walls on downstroke, plus a series of wide drainage slots. 1½" to 25" diameters.

Five Koppers Rings . . . worth their weight in gold!

What will American Hammered Industrial Piston Rings *do for you?* They'll save you money on fuel, on lubricating oil, on labor costs—by reducing down-time.

They'll maintain high compression, improve your operation, give you *much* longer service. They don't cost much . . . but they have over 35 years of manufacturing skill and accumulated experience behind them. They never let you down, they never fail in the jobs they're designed to do—and hundreds of satisfied users will tell you that, despite their low cost, Koppers rings *are* worth their weight in gold.

American Hammered Piston Rings are available in all types, all sizes—from ½" to 10' diameter—for every purpose. Koppers makes American Hammered Rings for all kinds of industrial equipment, can recommend without bias as to types. It costs nothing to consult Koppers—for illustrated Piston Ring booklet write to KOPPERS COMPANY, INC., *Piston Ring & Seal Dept.,* 1302 Hamburg Street, Baltimore 3, Md.

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FRAM Water Separator and Fuel Filter Removes All Water, Traps Dirt and Dust!

Here's complete protection for your fuel injectors! A FRAM Water Separator and Fuel Filter on diesel engines pays off by:

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FRAM pioneers filter developments. For complete details on Diesel applications, write: FRAM Corporation, Providence 16, R.I., or Fram Canada Ltd., Stratford, Ontario.

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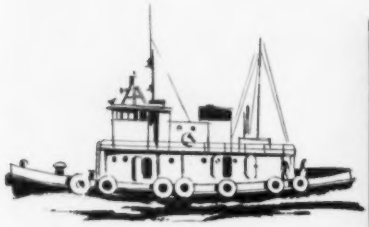
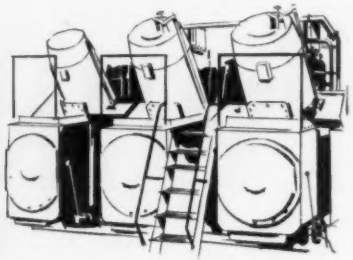
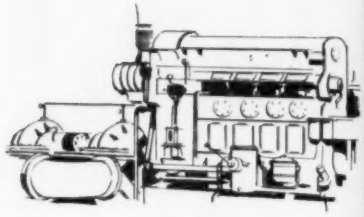


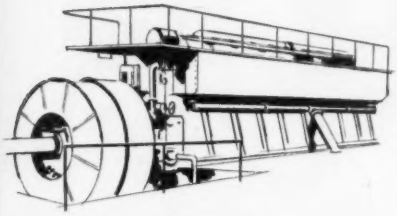
Marine



Engine compressor



Pumping



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WITH *Alnor*® PROTECTION

Accurate check of exhaust temperatures with an Alnor Pyrometer system can assure minimum fuel consumption per horsepower and long service from the power you bought—without the interruption of many common-cause breakdowns.

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CYLINDER OVERLOAD	SCALED JACKETS	DETONATION
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Series A Pyrometers are designed specifically for direct mounting on diesel engines or other equipment subject to vibration and rough usage. Readings are accurate to within + or −1%. Dustproof, fumeproof, splashproof. Switch capacities of 4, 6, 8, 10, 12 and 16 circuits. Other models to 31 circuits. Get full information—by return mail. Send for Bulletin 4361 with complete details of the Pyrometer and thermocouple assembly designed for your engine.

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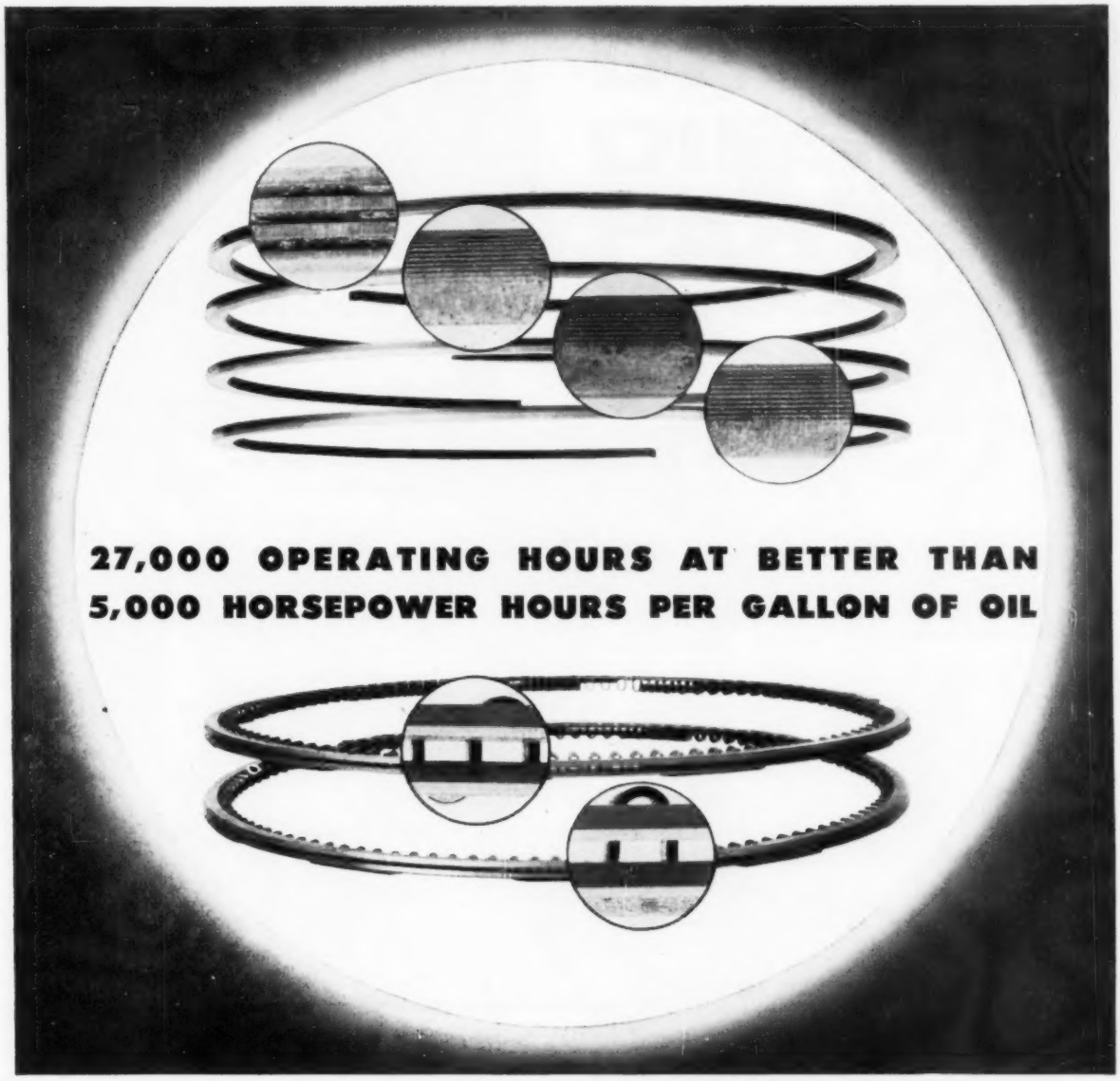

27,000 OPERATING HOURS AT BETTER THAN 5,000 HORSEPOWER HOURS PER GALLON OF OIL

ENGINEERED RING SETS IS A PEDRICK FIRST

In 1921, the first complete set of rings in a single package, engineered for a particular internal-combustion engine, was introduced *by Pedrick*. You get 35 years of experience and know-how, therefore, in the complete sets we engineer for diesel and gas engines.

That's part of the reason Pedrick Engineered Sets give the kind of performance revealed by the un-retouched photo above. These rings are from a Pedrick E3902 Set taken out of a Cooper-Bessemer GMV engine after 27,109 hours of operation. Oil consumption averaged better than 5,000 hp. hrs. per gal. Wear in the cylinders was almost insignificant—averaging only .00725 in. at the top and .0035 in. at the bottom. Ring tension remains at practically original production level. Each ring shows face-wear only about halfway up, so rings still are practically as good as *new!*

For *your* engine's own good, use Pedrick Engineered Sets with the latest ring designs in proper combination, illustrated installation instructions, a single package per cylinder. You'll also enjoy the benefits of simplicity in ordering and stocking. The same engineering know-how which goes into Pedrick Engineered Sets is available to help you with special problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, Pa. SAratoga 9-3770. In Canada: Toronto 2.

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GM DETROIT DIESEL PARTS

...factory-engineered for long life, low-cost service

CYLINDER LINER QUALITY CONTROL

In checking the metal's hardness for wear resistance, diameter dimensions are measured electrically as well as mechanically to insure perfect fit and interchangeability. Even the smoothness of the ground liner surface is recorded by this "on-the-production-line" inspection.

MODERN PARTS DEPOTS ALWAYS NEARBY

GM Detroit Diesel Distributors and Dealers from coast to coast carry complete stocks of factory-engineered GM Detroit Diesel parts. They're as near as your telephone—ready "round the clock" to keep your engines working and earning for you.

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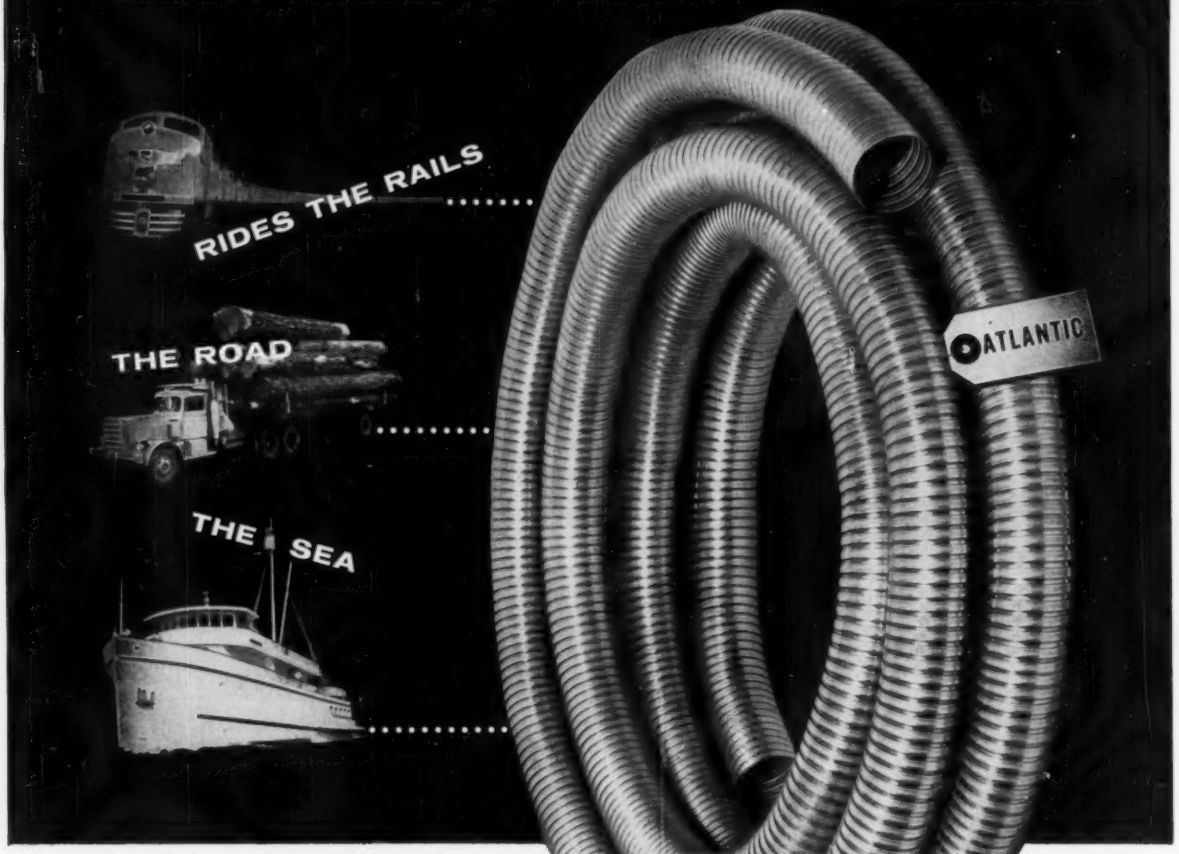
FLEXIBLE METAL HOSE

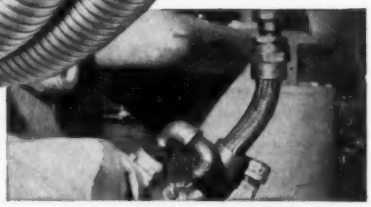


When diesels power trucks hauling 70,000 lb. loads of logs over mountain roads — or locomotives and ships, Atlantic flexible metal hose is usually given the job of guarding those vital diesel life lines—water, fuel, exhaust.

Atlantic flexible metal hose is manufactured to tough specifications.

Wall thickness is absolutely uniform. Tight against water, oil, steam, gas and air. Requires no maintenance. Atlantic flexible metal hose dampens vibration, remains flexible at higher temperatures.

There is an Atlantic flexible metal hose for each of these applications. Made in bronze, steel, stainless and monel—⅛"-36" I.D. with required fittings.



For misalignment and vibration

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Filtration For Every Known Fluid

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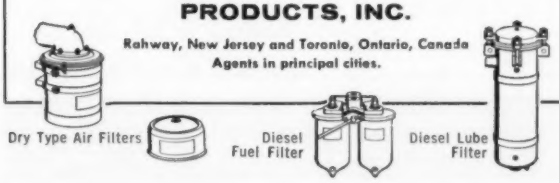


When several manufacturers install the same line of filters on a wide variety of equipment, there must be a good reason. For all the equipment shown above the reason is simply this: Purolator filters remove more dirt. That's all there is to it. In terms of engine wear, performance, and long life, this can mean the difference between dependable operation and breakdown. That's why more and more manufacturers of equipment which must operate in dirt and dust insist on the extra percentage of protection given by Purolator filters. Purolator's complete line for construction equipment includes filters for air, fuel, lubrication oils, and hydraulic systems; plus a complete line of screens and strainers.

The Engineer's Field Report

CASE HISTORY
LUBRICANT *RPM Delo Oils*
FIRM *McGrew Brothers, Medford, Oregon*

Logging trucks work 4 years in mud, dust, and snow without a single bearing failure

FROM LOGGING SHOW TO MILL is a rough 40 miles for McGrew Brothers fleet of B-61 Mack trucks. Four units like one above haul 20-ton payloads through mud, deep dust, or snow, 12 hours a day, five days a week. Mr. E. E. McGrew, partner in the firm, says, "Our trucks take a real beating. But RPM DELO Special Lubricating Oil helps us hold maintenance and replacement costs to a minimum. In the four years we have used this oil, we have never lost a bearing." "RPM DELO" Special is also used in all other equipment—four pickup trucks, two crew wagons, two water wagons, two loaders, and four Caterpillar-built tractors; three D-8's and a D-7. One of the D-8's went 5,000 hours before overhaul and, after inspection, four of original pistons were put back in service. Mr. McGrew designed unique push-arm rig (above), used to unload trucks and stack logs on cold deck.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U.S. PAT. OFF.

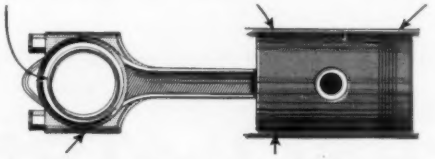
FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor, write or call any of the companies listed below.

Why RPM DELO Oils prolong engine life

Special compounds stop corrosion

Anti-oxidant resists lacquer formation

Detergent keeps parts clean

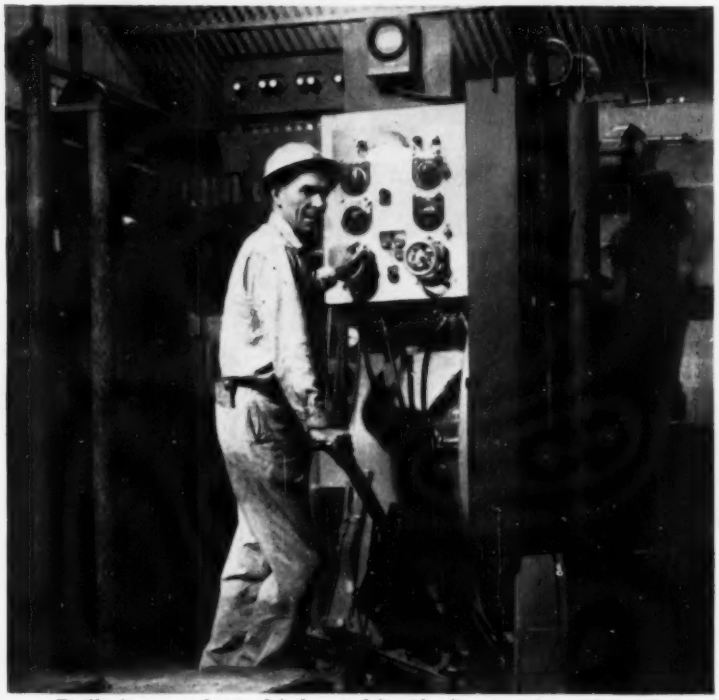


Inhibitor resists foaming

Metal-adhesion qualities keep oil on parts in running or idle engine

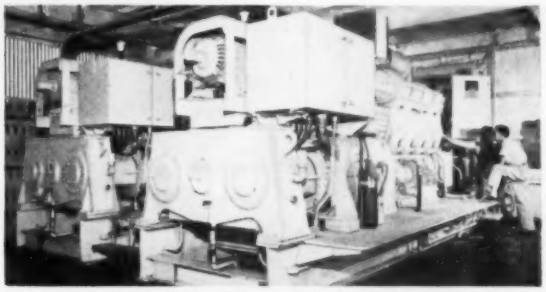
STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

A landlubber goes to sea . . .



Driller's control stand is located beside draw works and just behind rotary table. From this point the driller can oversee every operation. From one panel he has complete control of all Diesel-electric equipment.

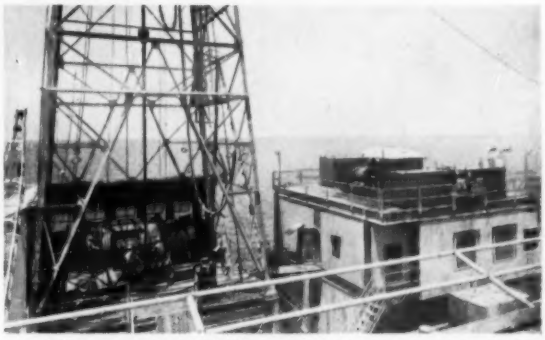
Two 875-hp dc drive motors supply power for draw works. Generators are connected to these motors through electric cables, permitting complete flexibility of arrangement. In fact, the entire Diesel-electric system can readily be adapted to any platform.



Conveniently located in a shed beside the mast are the two 975-hp generating sets. Each drives two 500-kw dc generators and comes complete on skids with controls and cooling system. Note how cables to drive motors are neatly routed on overhead trays.

BIG CHIEF uses Electro-Motive Power on first offshore rig

Big Chief Drilling Company of Oklahoma City was a landlubber for twenty years before plunging into offshore drilling. More than a year was spent studying offshore problems, designing equipment before launching Rig 34. Why they picked Electro-Motive Diesel-Electric Power is told here:



This view from the heliport which tops the crews quarters shows the simple and efficient layout of Rig 34. At left is the driller's stand, at right the engine generator shed. Below deck are pumps and tanks for mud, fuel and water.

Deck costs cut to minimum

Platform deck area measures only 88 by 145 feet. Living quarters, fuel storage, mud, water, pipe racks, etc., alone take 88 by 110 feet. In the space left (35x88), Big Chief's engineers had to pack a complete rig and provide for location of six wells. Solution: Electro-Motive Power with flexible cables permitted locating components in a space-saving three story design.

Big power, simple control

Two 875-hp GM Diesel engines driving four 500-kw dc generators supply power to 625-hp drive motors on mud pumps, rotary and draw works. Coupled with this power is a simple and accurate control system that provides smooth and rapid acceleration of loads with positive control of speed and torque. Result: flexible control for faster, lower cost drilling.

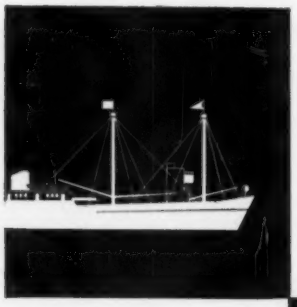
Matched components

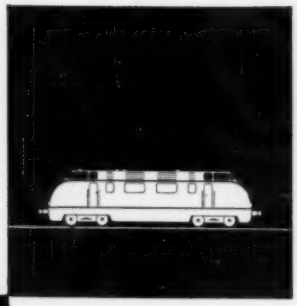
Electro-Motive Power is a complete drilling power system. Each component was designed and built to work together—one manufacturer—one source of responsibility. The tested dependability and widespread acceptance of this power is proof of its drilling advantages on land or water. For your convenience there's an Electro-Motive Representative located in every major drilling area.

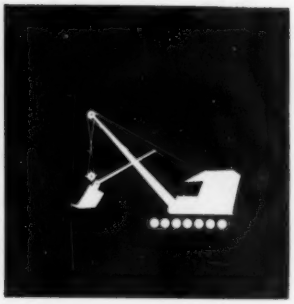
ELECTRO-MOTIVE DIVISION
GENERAL MOTORS LA GRANGE, ILLINOIS

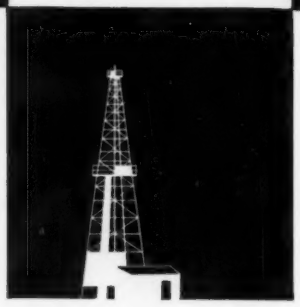
In Canada: General Motors Diesel Limited, London, Ontario

Petroleum industry sales offices: Tulsa, Oklahoma; Houston, Texas; Dallas, Texas; Morgan City, Louisiana; Pasadena, California.









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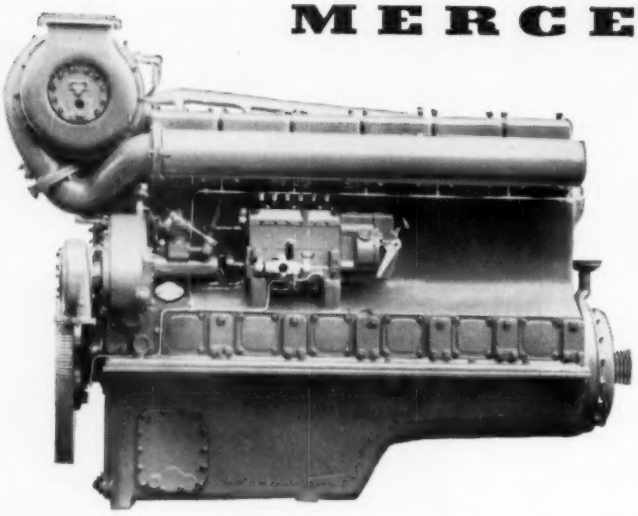

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stationary and mobile
power plants,
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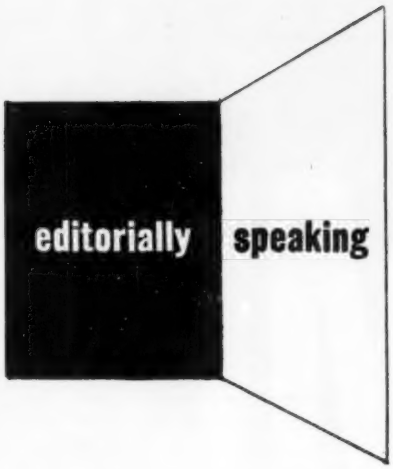

No Time For Relaxing

Drag your heels today and you're licked. There are more ideas and new developments cooking in our industry than ever before. The foreshadowing of the future and the substance of today is turning a lot of high-powered attention on our field. Plus what the industry is doing, newcomers with fresh ideas from other fields are eyeing both the new-production sales and the more-than-ten-times-as-big replacement market. Things are stirring. There are at least three foreign engine designs being built under license that are due to pop any day. There's a new turbocharger in prospect and several foreign designs are being offered on the American market. Builders of automotive specialty parts are looking for new market fields. Tool builders are designing special tools and adapting standard models for diesel repairs. It adds up to the point where the diesel pie, original-equipment crust and replacement-market filling, is appetizing enough to make others want a slice. The diesel engine companies that built up the industry deserve and should get the biggest hunk of pie. But it's not enough to have earned it; you have to keep earning it in the full reality of changing conditions. Leave a vacuum and someone moves in. And there have been a lot of vacuums filled already. Some engine builders have been as alert and alive as a month-old pup. And their sales figures show it. Others appear to be in the "old dog" stage but they'll have to learn "new tricks" if they're to keep up with this fast-moving field. There's terrific competition for the customer's buck and with his freedom of choice today, it's a buyer's market. He can discriminate and does. You have to meet *his* concept of values, performance and, particularly, service. He has the automotive industry pattern of immediate parts availability at realistic prices, convenience of repair facilities and free interchange of service data for comparison. Meet his requirements or someone else will. No one can stop current trends or should want to; it's part of progress. It's a case of gear up to today's realities or be left behind.

B P E

Sealed Power offers the best piston rings ever made for Diesel engines

CHROME plus Cyclan

Chrome facing licks:
- HEAT
- ABRASION
- FRICTION
- CORROSION

Cyclan ring defeats:
- BREAKAGE
- SIDE WEAR
- FRICTION
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This combination may be the perfect one for your Diesel engines. Sealed Power engineers will welcome an opportunity to discuss the subject with you at your convenience.

Write for "The Cyclan Story"

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Sealed Power Piston Rings

PISTONS • CYLINDER SLEEVES

Leading Manufacturer of Automotive and Industrial Piston Rings Since 1911

Largest Producers of Sealing Rings for Automatic Transmissions and Power Steering Units

highlights

Curtiss-Wright is actively negotiating with Daimler-Benz for all its products for distribution through Studebaker-Packard outlets.

C-W is using its Utica Plant for exploratory work involving the German diesel for bus and possibly truck use.

New drive principle for industrial tractors, stealing a page out of railroad practice, has been developed by Automatic Transportation Co. A generator, direct-coupled to a Continental engine turns a high-torque electric-drive motor. They claim all the advantages of diesel-electric drive found so useful by the railroads, including dynamic braking.

And on the other hand, Hyster heavy offhighway equipment lift trucks are following trends, using a torque converter drive. This type transmission is available as optional equipment on all new 3000- to 5000-lb capacity units.

Pacific Intermountain Express has recently opened, in Los Angeles, what is perhaps the largest truck overhaul base in the U.S. They say the shop is equipped to overhaul three rigs, put two reconditioned trailers back into service and take care of 300 minor service jobs every 24 hours. P.I.E. has linked this new shop to their 705′ terminal.

A device for reducing horsepower demands from engines when operating at high altitudes has been developed. This is to be added to the engine governor. Also, a governor for a combined diesel and third rail electric locomotive as well as one for gas turbine locomotives has been developed and is being produced by the Woodward Governor Co.

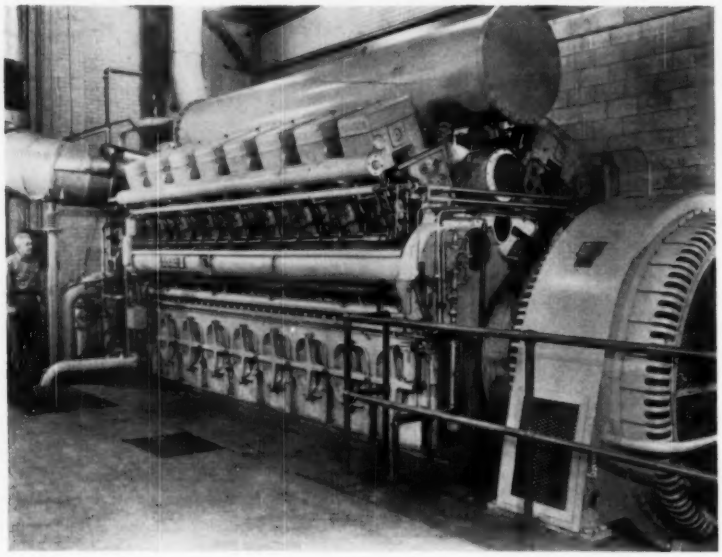
Fuel oil consumption during October 1956 totaled 6,266,168 barrels, although not a record, its an increase of 3.8% over October 1955's consumption of 6,037,548 and 20.5% above that for September 1956. More competition for the distillates and a push toward more use of heavier fuels.

Diesels are handling more than 85% of freight traffic and 91% of switching on American railroads, reports the November-December issue of the CHICAGO AND EASTERN ILLINOIS FLYER magazine.

The Aluminum Association reports that the supply has now caught up with demand. Now it's freely available for increased usage including engine construction and components. As uses increase it could foreshadow another round of expansion and more pot lines powered with internal combustion engines.

Greatest number of diesel engines produced in 1955 have a 51 to 70-hp range, according to the December issue of Facts for Industry, prepared by the Bureau of Census in Washington, D. C. Over 39,000 of the 152,000 diesels produced are within this range. The second most popular size is the 301 to 400-hp range.

Petroleum supply and demand in U. S. hit new peaks in 1956. In spite of the Suez crisis, total supply and demand exceeded nine million gallons a day for the first time in history, says Frank M. Porter, President of American Petroleum Institute. Production of natural gas also rose substantially, exceeding the 1955 record by 840 billion feet gross.



This Nordberg Supairthermal 16-cyl, 13-in. by 16½-in., 3660-hp, vee-type, dual-fuel engine is the latest addition to the Woodstock, Ill., municipal steam plant. Operator Karl Schacht looks over the new unit.

Steam Plant Economizes With Dual-Fuel Engine

Nordberg dual-fuel engine intended for back-up power in Woodstock, Ill. municipal steam plant is assuming a major role in the interest of better overall plant economy.

ANOTHER completely independent municipal steam power plant has resorted to a dual-fuel engine for security and economy. This time it's the one in Woodstock, Ill. This plant has no tie-in with the power utility which surrounds them. And according to the city manager, William Day, since residents and industry couldn't risk having all their eggs in one basket, the dual-fuel generator set was added.

This latest addition is a Nordberg Supairthermal dual-fuel engine rated 3660 hp at 514 rpm. Installation of this 2610-kw unit has increased the three-turbine plant's capacity from 14,000 to 16,610 kw, more than double the peak demand.

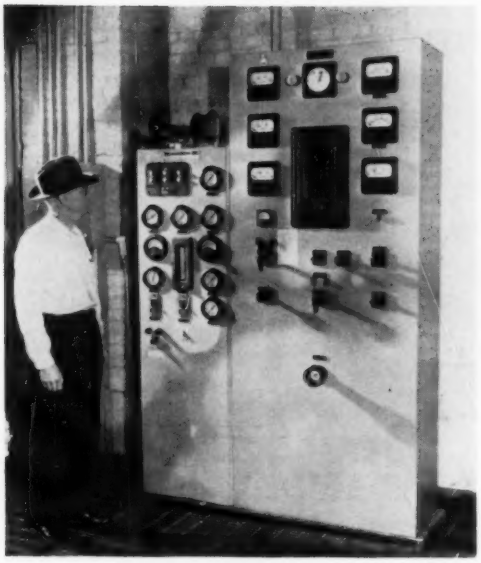
The dual-fuel unit was originally intended for just standby service. It can be put on the line in a few minutes and supply total residential load. A standby turbine takes from 60 to 120 minutes to do the same thing. The new unit can also be placed on the line quickly to meet peak loads when the two low-pressure turbines are not ready for quick cut-in.

In addition to giving all these advantages, the dual-fuel unit has demonstrated its operational economy on natural gas to such an extent that it has been used as a base-load unit during the summer months. By generating about 10% of the monthly production of over 3,100,000 kwh it has reduced the entire plant operating costs.

The October 1956, plant report showed that the average fuel cost per kwh for the steam turbine was 5.40 mills. Average fuel and lube oil cost per kwh for the dual-fuel engine operating on gas was 4.95 mills. This made the combined average fuel cost per kwh generated 5.37 mills.

The dual-fuel engine is especially economical during the summer when natural gas only costs 3.81 cents per therm. This is less than half the normal cost of diesel oil at 12.131 cents per gallon.

Even when running on diesel oil during the winter months, the Nordberg engine is the most economical unit in the plant, especially for short peaking purposes. For this reason it is being used more frequently than in the past. And since Woodstock may have year-around gas service in two years when gas pipeline capacity is in-



Plant superintendent, S. L. Gunderson is seen checking the pyrometer, alarms, manometer, etc. on the guage board.

creased, they are looking forward to even more frequent use and economical operation of the unit. Three recent increases have raised coal price to $7.51 per ton and increasing freight rates are also adding to the steam power generation cost.

Woodstock also has other problems. One industrial customer alone requires 52% of the average plant weekday load. This power requirement is for the manufacture of automobile instrument panels and is fairly steady. But any seasonal or hourly fluctuation immediately affects the whole plant operation.

Woodstock has 3318 customers, 2896 residential and 422 commercial. Load peaks occur from 10 to 11:30 A.M. during all seasons and from 4:30 to 6:00 P.M. in winter. Main turbine capacity is 7500 kw at 80% P.F. The dual-fuel unit is now used for all peaks. These have reached 8200 kw or more during the winter. During these peaks the turbine is loaded so that the dual-fuel engine operates at ½ to ¾ load.

Woodstock has 40 miles of transmission lines which extend 2½ miles into the surrounding country. It is located in the geographical center of McHenry County Seat. The city's financial report for the last fiscal year shows that the light and power system produced 64% of the city's income. It also produced 75% of it's favorable dollar balance.

Uninterrupted service in all weather plus these favorable earnings are two important reasons why Woodstock's citizens like their independent municipal system. The protection and economy obtained by the addition of the dual-fuel unit is the latest example of how this well run community anticipates requirements and is ready to handle any emergency.

Diesel Locomotive Doubles Effectively as Road & Yard Switcher

A NEW 1200-hp Fairbanks-Morse diesel locomotive combines the high train-heating and fuel capacities of a road switcher with the lower first cost and operating economies of a yard switcher.

The Santa Fe Railway is now using these new models in terminal service. Their purpose is to move assembled trains from coach yard to station, and provide an ample source of heating and cooling (Santa Fe uses steam injector air conditioning in summer).

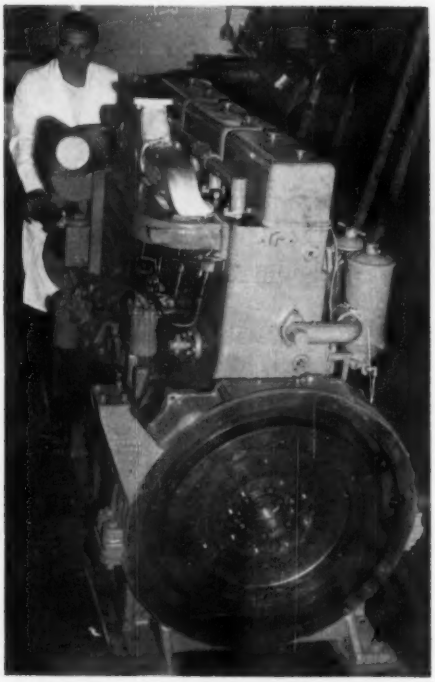
Each unit is 55-ft 4-in. long, 10-ft 6-in. wide, 14-ft 6-in. high, and weighs 246,000 pounds, all on drivers. The locomotive is constructed on the standard Fairbanks-Morse Model H 16-44 road switcher underframe, except that switcher-type friction draft gear and switchmen's footboards are used, and the pilot is omitted.

Two 1200-gal tanks, one for oil and one for water, are mounted beneath the underframe between the trucks. A standard F-M switcher 1200-hp opposed-piston diesel engine, accessories, engine hood, and cab are mounted on this underframe. A short hood structure, or doghouse, large enough to accommodate a 4500-lb per hr capacity steam generator, largest now used in rail service, is also mounted on the underframe.

The cab structure and equipment arrangement are identical with those used on the standard F-M switcher but are modified slightly to permit cab entry on both sides as on a road switcher. Externally, the unit closely resembles many F-M road switchers now in service.

All rotating electrical equipment is manufactured by Fairbanks-Morse, including an extra 7.5-kw auxiliary generator to furnish power for the steam generator. However the control and switchgear are made by General Electric.

Air brake equipment is of the 6SL type. In terminal service, switcher-type trucks with plain bearings are used. For higher speed road-switcher work, standard roller bearing-equipped swing bolster trucks can be applied as a modification.



This 6-cyl Buda diesel engine Model 6DC-1742 has been completely rebuilt at the Taylor shop, tested and run-in. It's now ready for delivery to customer.

Talking Shops

Continuing Diesel Power's interviews with the men who supervise engine rebuilding shops. In this case, special emphasis on techniques and tooling for precision work, and a specialty in converting 4-cycle small industrial diesels to dual-fuel, make this another outstanding shop.

EVERY diesel repair shop visited by Diesel Power has a specialty—something to boast about. The H. D. Taylor Co. in Buffalo boasts about its precision work in engine rebuilding. Their specialty? Conversion of industrial diesels to dual-fuel operation.

The engines involved are—any and all model diesels used in equipment such as rock crushers, tractors, cranes, bull dozers, shovels, scrapers and locomotives, as well as industrial pumping units, generator sets, etc. From 40 to 60 engines are being worked on at one time at the Taylor shop, which is also a Waukesha Motor Co. distributor.

Walt Hipwell, Mgr. Industrial-Engine Div., says, "We are one of the largest industrial engine rebuilders from New York City to Chicago."

Let's have Walt take us around the shop so we can ask some questions about what goes on there. We'll do this first and later discuss the diesel conversions to dual-fuel.

"Walt, how is your shop layed out?"

"It's sectioned off into departments, each with one or more specific functions. The engines and parts follow a specific course through each of these departments. They start out in the tear-down and inspection department and continue on through the cleaning; radiator repair; engine rebuilding; fuel injection and governor; electrical; assembly; and test and run-in departments. Of course we also have a parts department."

"What happens to the engine when it gets here?"

"First the outside is cleaned and essential data from the name plate is recorded on a numbered service card. From now on the engine is identified by this number alone. Then it's disassembled. No effort is made to find out what is wrong with the engine. Once it's here, it's for only one reason—to be rebuilt.

"After it's torn down, parts are inspected to determine which are to be replaced and what has to be done to rehabilitate those to be reused. This is also recorded on the service card. Parts to be replaced are discarded and new parts for most engines are obtained from stock. Those for old or obsolete engines are ordered. The remainder are sent to the cleaning department."

"What method is used to clean these parts?"

"The parts are submerged into a tank containing some cleaning solvent. This tank is large enough to accommodate even blocks of the largest Buda engines handled by us. Low pressure air agitates the solvent and keeps a turbulant action around the parts. This "scrubbing" results in efficient cleaning. We also steam and hot-water flush engine parts."

Men in radiator repair department of the Taylor shop can be seen testing submerged radiator cores with air pressure. Others are seen soldering or welding the leaks located during the testing.

"What if you find a leak?"

"Leaking cores are repaired by brazing, welding or by silver soldering. After being repaired, the cores are tested again. If satisfactory, the cores are then connected to a test-flow tank with which we determine their flow rate. This must be from 3 to 5% of factory specification or the core is replaced."

"How about taking us through your engine rebuilding department?"

"In this department, precision is the byword and we have the machinery for it. The boys say that I am a fanatic for precision work and this attitude seems to have passed on to each of my mechanics. This will become more and more apparent as we discuss what is done to each engine part and the machinery used to do it. Let's take one part at a time."

"What happens to the parts after they're cleaned?"

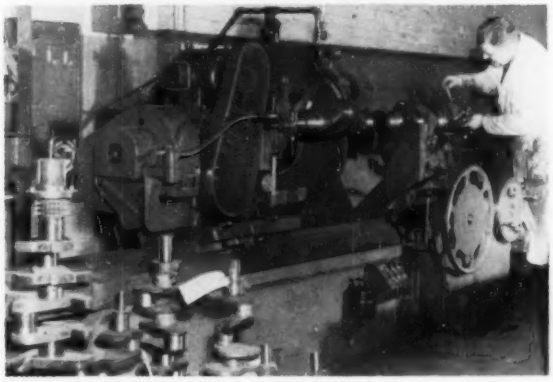
"When parts are clean, they are removed and allowed to drain, then they're distributed to the various shop departments depending on what is to be done to them. Those parts that need nothing but cleaning are placed in a properly-labeled box. As new parts are received or old ones rebuilt, they are also placed in the box. When every piece of the engine is in the box, the engine is assembled."

"Walt, let's discuss the parts to be rebuilt. For example, here's a radiator, what happens to it?"

"It goes to the radiator department where it is first boiled in an Oakite solution for cleaning and descaling. When cleaned and drained, it's sealed at one end and low pressure air is connected to the other. It's then submerged in a water tank to test for leaks. To make sure that even the smallest leak is detected, the core is rapped lightly with a hammer to loosen any scale or rust which may be sealing a leak."

This large line boring machine was specially built for the Taylor Co. by Tobin-Arp. It is not a standard size machine. Saddles are trued up or bearings are installed in the engine block and line bored depending on the engine and type of bearings used.

Crankpins and journals are reground to a standard undersize on this Van Norman crankshaft grinding machine. Machinist is checking the diameter of a crankpin and runout with an outside micrometer. All crankshafts at lower left are to be reground.



"How about starting with the crankshaft?"

"Fine, this is first placed on a magnaflux machine to locate cracks and surface checks if any. If okay, it is then checked for diameters and runout on a lathe. The maximum runout permitted is 0.0001-in. If more, it is recentered.

"If necessary, the pins and journals are reground on this crankshaft grinder to a standard undersize depending on where they clean up. Generally, 0.010-in., 0.020-in., 0.030-in., or a maximum of 0.040-in. undersize bearings are used.

"When more than 0.040-in. must be removed to true up the shaft it is discarded. If a replacement crankshaft can't be obtained for an obsolete engine, or delivery is too long, the shaft is sent out to be chrome plated. This plating is

The connecting rod eye is being bored on this Tobin-Arp precision pin-fitting machine prior to fitting the piston pin. When the rod is mounted for boring the pin hole to size, this machine automatically aligns the pin hole with the connecting rod bearing hole.

never more than 0.020-in. on the diameter. Then, standard undersize bearings are used."

"What's the story on saddles?"

"New bearings are always used for both crank pins and journals. These three different size line boring machines handle the smallest to the largest blocks going through the shop. Saddles are trued up or bearings installed and bored, depending on engine and type of bearings use. Incidently, this half-bearing machine is generally used to correctly size and fit bearings for obsolete engines."

"Do you check con rod alignment and fit piston pins here?"

"Yes we do. We use a new precision pin fitting machine to fit the pins. When the rod is mounted for boring the pin hole to size, it automatically aligns the two holes. Also during mounting, center to center distance is set to 0.0001-in. (See Diesel Power, October 1956). Getting this exact same tolerance on every con rod permits better engine balancing, resulting in smoother running."

"What do you do about pistons?"

"Well, if the liners are replaced we get new standard-size pistons. When a cylinder is rebored, standard oversize pistons are used. Sometimes, if pistons for old or obsolete engines can't be obtained readily, semi-finished pistons are cut down on a lathe and ground to size on one of these two piston grinders. Every piston in an engine is ground to exactly the same size. We can handle pistons up to 8-in. diameter."

"Walt, what is your policy on liner replacement and reboring?"

"We always replace all sleeves, we never rebore or grind them. The only time we rebore is when there are no liners. This is done with one of these four cylinder reboring machines. However, most of this cylinder reboring is on gasoline engines and a few older diesels.

"We make sure though, that the block bore for the liner is straight and round. The flange counterbore and seal ring area with wet sleeves are carefully checked. If you don't have correct protrusion above the block face where it is specified, you can get bad liner distortion."

"I see that you have a couple of cylinder head grinders. Do you do all your cylinder head repairs here?"

"Yes, practically all of it. This includes grinding heads, replacing seat inserts and valves. We make sure that head to block fits are accurate, grinding head, block or both if necessary. Valve seat inserts and guides are practically always replaced. Generally we replace the valve, but in a few cases we reface them on one of these three valve grinders. But they have to be in good condition as determined by careful inspection including a zyglow check.

"We also weld cracks if they're not too big. When the damage is too great we send them to the Stark Co., in Long Island City, N. Y., for their special welding process and head rebuilding."

"I don't see any camshafts around. How come?"

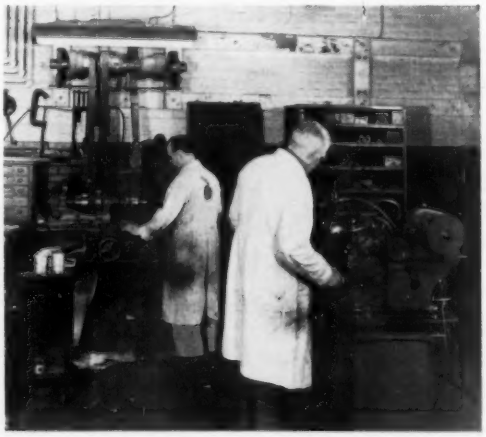
"We send them out to have the cams built-up and reground. First, we magnaflux them to make sure that it's worth while."

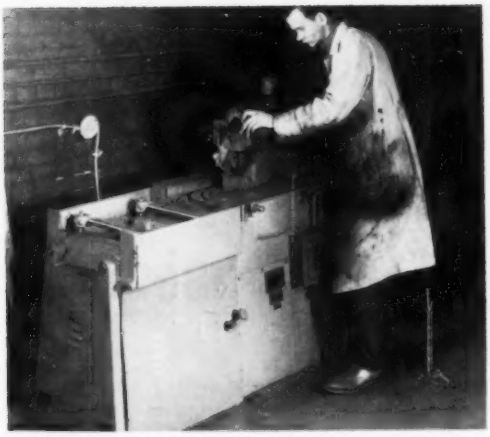
"How is the injection equipment handled?"

"Let's go to the fuel injection and governor department and I'll show you. We can rebuild any type of injection equipment and have done so, but the major part of our work is with American Bosch. You can see by the calibration machine and nozzle testers that we have the necessary tools.

"Incidentally, governors are also rebuilt in this department. As a matter of a fact, we replace most of the centrifugal type governors used with the Bosch pumps with the hydraulic and vacuum type. We think we get finer speed control and smoother engine operation. Our customers are very satisfied with the results."

When standard oversize pistons can't be obtained readily, semi-finished pistons are cut down on lathe at left and then ground to size on the piston grinder on the right.





Cylinder head and block fits must be accurate. If necessary both are ground. A gasoline engine block is seen being ground on a Lempco cylinder head grinding machine. But this grinder is used primarily for grinding diesel cylinder heads.

"Do you rebuild any other engine parts or accessories in the shop?"

"Yes, here is our electrical department. The boys inspect, rebuild and test all starting motors, generators, voltage and current regulators. We also rebuild or repair all engine components and accessories. Plus this, we rebuild torque converters, transmission gears, and driven equipment such as compressors, pumps, generators, etc., that come in with the diesels."

"How can you tell when all engine parts are back in those boxes and ready for assembly?"

"A check of the service record shows that. By the way, about 99% of the time, the man who disassembles the engine reassembles it. He is familiar with the engine and its parts and gets the job done faster, less expensively, and with least after-troubles."

"Does he also test the engine when it is assembled?"

"No. He starts it and if it starts up readily, it's sent to the testing and run-in department. Here we have our 500-hp dynamometer. The engine is connected to it and started. By this time the engine has been filled to the proper level with a low-additive type lube oil. This is drained out after the engine is run-in on the dynamometer. The engine is then properly tagged and shipped dry so the customer can use the oil he wishes.

"Our break-in schedule calls for:

1-hr at ¼ maximum speed no load.

½-hr at ½ maximum speed ¼ load.

½-hr at ¾ maximum speed ½ load.

½-hr at full speed ¾ load.

"During this time the engine is continually checked for leaks, temperatures, pressures etc. It is stopped immediately at the first sign that something is wrong.

"After the last ½-hr run, the engine is stopped, heads are retorqued, valves reset, etc. Then the engine is started again and run for 3 hours at ¾ maximum speed ¾ load. It is stopped again, inspected and adjusted if necessary. Then it is run for 4 hours at full speed, full load.

"At this time, if 95 to 98% of the rated horsepower is developed, and lube oil and fuel consumption is in accordance with manufacturer's specs, the engine is considered run-in. If results are not satisfactory the engine is run-in longer."

"What is the average run-in time?"

"About 10 hours. But sometimes longer depending on engine size, application, speed and if engine-driven equipment has to be run-in with the engine. Sometimes the customers ask for a longer break-in period because they know the value of this service, for which we charge at an hourly rate. We've been told by many of our customers that about 75% of our rebuilds last longer than when the engines were new and give less trouble. We give the same guarantee as a new engine manufacturer."

"Tell me something about your parts set up."

"We stock a lot of parts for the popular engine models. These parts are always bought from the engine manufacturer. This is to insure the guarantee provided by the engine manufacturer. Parts are ordered in line with the quantity used and also according to our experience in how fast we use certain items for specific engines. Some engines wear out certain parts faster than others.

"We keep accurate records on all parts, in fact, we keep a record of everything that is done around here. In addition to a parts record card, we have an engine record card, an equipment service card and a detailed service record card. The last two are made up especially for the customer and sent to him with the engine to show exactly which parts were replaced and the work done."

"Walt, what about the dual-fuel conversions?"

"We are converting 4-cycle diesels of small industrial and automotive sizes to dual-fuel operation, and as far as I know, we're the only ones that do this in the Northeast. We reduce the diesel fuel by about 30% and supplement this with the same amount of Liquid Petroleum Gas (LPG) into the intake air stream."

"What are the advantages?"

"It reduces exhaust smoke and increases horsepower by about 15%. You get this increased power when the LPG mixes with and burns more of the diesel fuel already in the combustion chamber. In other words, it burns the fuel oil more completely and we find that it produces more power with less smoke.

"It also gives easier starting in cold weather, and increases lube oil life considerably in some applications. There is less dilution and contamination. Parts wear is also reduced since a better lube oil film is maintained on the cylinder walls during stop and go operation. Also, in some places the cost of LPG is less than fuel oil, and there is a savings in fuel costs."

"Is it a complicated conversion?"

"No it's simple and relatively inexpensive. All that is done in addition to limiting the amount of fuel delivered by the pump is to install a regulator, gas-air mixer, controls, and a special LPG storage tank."

The equipment service record is sent to customer with rebuilt engine. On front it lists new parts used. On back, customer's mechanic lists all future work done on engine. Form second from top is a detailed service record and is sent to customer with invoice. It shows work done and lists parts used. Third form lists engine parts in stock for each engine model. Bottom form, kept in triplicate, gives complete record of everything done, how and why.

"What are the functions of these parts?"

"The LPG passes from the tank through a filter and a solenoid shut-off into the regulator where it's converted into a "dry-gas". This is done in two stages, the first vaporizes the fuel, and the second reduces the fuel to atmospheric pressure. Jacket water lines from the engine are connected to the regulator to supply heat during gas vaporization to counteract the refrigerating effect produced.

"As intake air flows through a venturi in the mixer, the LPG is drawn into the air stream in proportion to the flow. This mixer is designed so it doesn't restrict the air flow in any way, while the regulator limits the maximum LPG admitted to 30%."

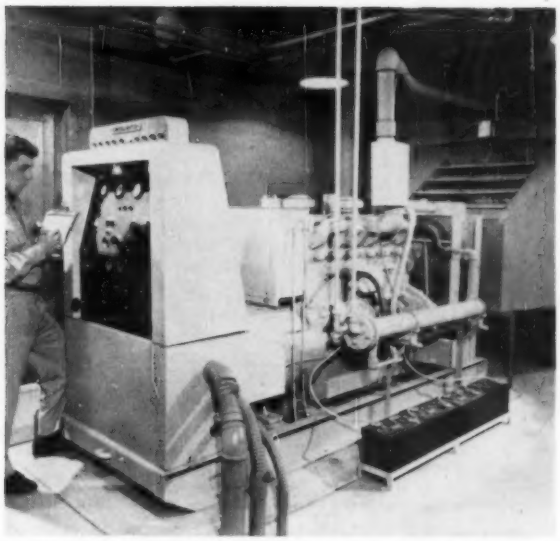
"Thanks Walt, you have been very cooperative, and we've learned a lot."

List of Major Tools

Valve Refacing Machines	Black & Decker Co.
Cylinder Reboring Machines	Van Norman Co.
Cleaning Tanks	Own Make
Magnafluxing Machine	Magnaflux Corp.
Valve Seat Grinders	Black & Decker Co. Sioux Corp.
Crankshaft Grinder	Van Norman Co.
Line Boring Machines	Tobin-Arp Mfg. Co.
Pin Fitting Machine	Tobin-Arp Mfg. Co.
Piston Grinder	Tobin-Arp Mfg. Co.
Lathes	Van Norman Co.
Cylinder Head Grinder	Lempco Corp.
Dynamometer	Clayton Mfg. Co.
Half-Bearing Machine	Tobin-Arp Mfg. Co.

Power Insurance For Radar Sites

Package diesel generator sets take over when main power fails. Automatic controls do the whole job and also keep the distant control center informed of their status.



Consolidated Diesel's Model 4000 automatic packaged-unit consists of a diesel generator set designed around an electric "brain" or control cabinet which permits unattended operation. The Buda Model 6DC844 diesel used in the set is rated 110 hp at 1200 rpm.

AN automatic diesel power plant which features an electric "brain" and built-in "memory system" has been developed by the Consolidated Diesel Corp. The power plant is made up of two diesel generator sets and is designated as the Model 4000. The two Buda Model 6DC844 diesels used are rated 110 hp at 1200 rpm.

The power plant, practically thinks for itself. It operates unattended, turns itself on and off and sends signals about operating conditions to a control center miles away. It was developed for standby service in radar systems in the U.S. and is now being delivered to the Dept. of Defense.

Should the normal power supply from commercial lines fail, or vary in anyway, the power plant turns itself on. It can handle full load in less than 12 seconds.

Through use of associated equipment, the units constantly relay operational information to the central control point. For example, if one set can't operate at full capacity, or fails for any reason, the second unit automatically turns itself on and picks up load. At the same time, the defective unit turns itself off and relays to the main control center that it has failed and why.

The unit is able to do this through the "memory system" which records control or mechanical troubles or unit failures. It indicates to technicians at the control point what repairs are necessary and what parts need adjustment or replacement.

As another example of its automatic operation, the Model 4000 disconnects the load from the commercial power supply before taking over. This protects against damaging equipment or feeding back into the commercial power lines.

In addition, when the outside power source fails, both diesels start at once. The first to reach full power output sends a signal to the second unit. The second unit then turns itself off. It returns to a standby condition, ready to take over if the first unit should fail.

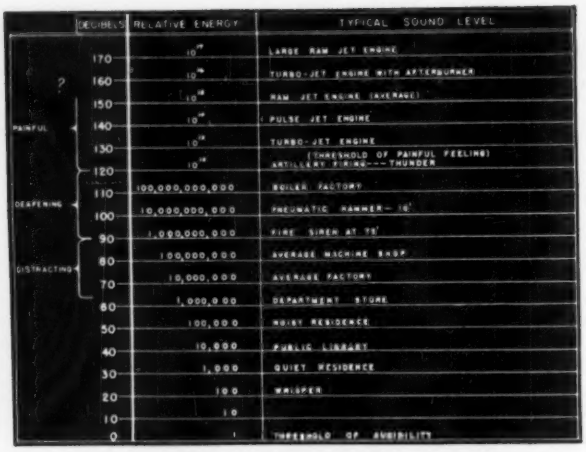
As an extra precaution, the power plant makes an automatic 2-hr check of the commercial power supply voltage after this voltage has returned to the correct range. If this voltage remains within specified limits, the unit returns the radar equipment to commercial power, shuts itself off, and returns to standby service.

These units are designed specifically for "gap-filler" radar stations spaced between main and auxiliary radar installations.

The equipment powered by the automatic generator sets provides a fence or alarm system between the main and auxiliary stations. Automation of the Model 4000 frees personnel and permits the radar line to be operated with a minimum of trained technicians. At the same time it cuts the possibility of human error.

This equipment plays a large part in operations of the (SAGE) Semi-Automatic Ground Environment system. Their "gap-filler" stations spot aircraft and feed the information into digital computers in which flight plan data has been recorded. This pin-points the position of any overhead aircraft at all times.

Con Diesel holds an Air Force contract for about $3-million to supply the Model 4000 to four-fifths of all "gap-filler" installations in the U.S.



This chart gives an idea of the intensity of sounds given off by many common places and things with which we are familiar and the effect of these sounds on human ears.

Noise Costs Money

By John E. Overend— Sales Engineer
Industrial Sound Control Dept.—Koppers Co. Inc.

Noise is more than just a nuisance—it's a serious industrial problem. Its effects are subtle and far reaching. Here is why noise control is important and how to do something about it.

NOISE costs you money. It's a serious industrial problem. And with increasing power and size of industrial equipment it's getting worse.

Noise is a problem for several reasons:

1. Power plant operation is a constant challenge to good public relations due to the noise produced by fans, generators and engines. This can be extremely annoying to people living in the immediate vicinity.
2. Some industrial noise can damage human ears and claims for compensation for loss of hearing attributed to industrial noise is costing companies millions of dollars.
3. Noise disrupts communications, lowers efficiency, causes annoyance and worst of all causes accidents through interference with warning sounds or signals.

Whereas the last two problems noted above have become of great importance to industry only in the past few years, the public relations problem is a long-standing one. And with today's rapid expansion of communities close to, and around existing power plants, this problem is as serious as ever.

Solving the Noise Problem

There are two basic ways of fighting this community, industrial-noise problem in existing plants:

1. Suppress noise at its source by redesign of machinery or if feasible relocate it. If this isn't practical—
2. Isolate noise by insulation and building structures around it.

To reduce noise from existing equipment several things can be done depending on its size and location. Equipment can be mounted on rubber pads or coil springs, or if practical the existing concrete foundation can be separated from the concrete floor. In some cases wood-block flooring may be used in place of cement.

Intake air and exhaust silencers have already greatly reduced power plant noise. Firms specializing in noise suppression are continuously improving these mufflers as well as other noise suppressing equipment. Their research departments are always making extensive studies of engine and other power plant equipment noise. It is often through their efforts and recommendations that less noisy machinery and/or improved noise silencing equipment is made.

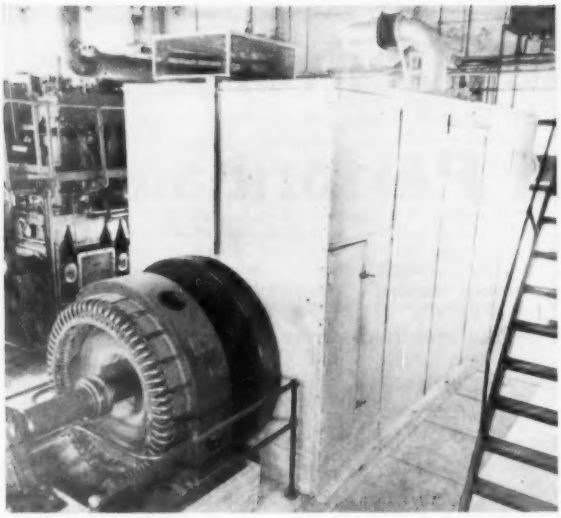
Vibration-isolation hangers should be used to support all pipe connections to the engines or other equipment. These hangers can also be passed through noise-insulators in contact with the walls or ceiling. Another way of reducing power plant noise is to select power-transmission equipment and tools which are as noiseless as possible.

If sound-suppression at its source is impractical, it may be controlled in other ways. For example, reflected noise from walls and ceilings combine with new noises and become very loud. Walls and ceilings made of sound-absorbent material such as glass-fibre or covered with mineral-wool material would cut this sound considerably.

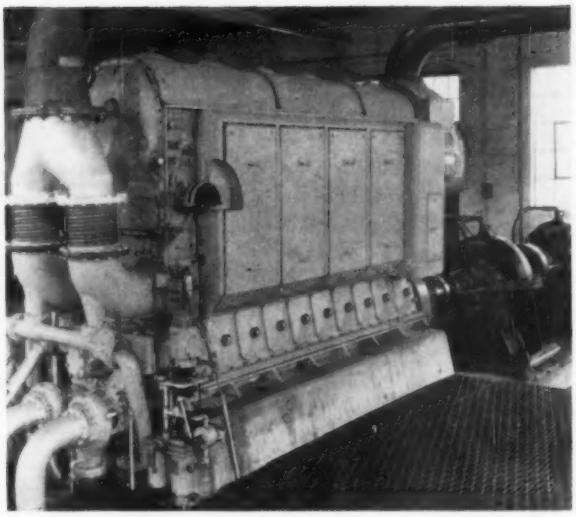
Still another way is to enclose either the machinery or the worker's area with permanent sound-absorbent panels, sound traps, or portable sound-barriers. These units, or combinations or modifications of them, are designed to meet practically all possible noise situations.

As an example of how far you can go in suppressing noise, one company, the Koppers Co., Inc., is able to effectively control the noise of jet aircraft during factory-testing. This is done by completely enclosing the unit with silencing panels made by their Industrial Sound Control Dept. If this extreme example of industrial noises can be controlled your problem can certainly be solved.

Up to now we have been discussing the solving of noise



An acoustic hood was placed around this Alco diesel at the Thibodaux, La. municipal plant to prevent the noise level from rising above that of the existing engines since this plant is located right in the middle of the city.



Fairbanks-Morse Co., has been forsighted in providing noise abatement covers for their opposed piston diesel engines. These sound deadening covers have proven very efficient.

problems outside the power plant. Yet there is another aspect—one which is considered by many to be even more serious and more costly—noise inside the plant.

Noise—An Occupational Hazard

Noise has a noticeable effect on a worker's nervous system. An increase in blood pressure; muscular contraction which results in excessive fatigue, and interference with reception of auditory danger signals—all attributed to high-level industrial noise—have a detrimental effect on general safety.

To understand how noise harms the ears we must understand that sound is basically rapid pulsations in air pressure produced by a vibrating source. To most of us noise is an unpleasant or unwanted sound.

Contrary to popular belief, industrial noise doesn't generally harm the ear drum, it damages the inner ear. Unfortunately this is worse since the inner ear cannot be repaired once it's damaged. Even hearing-aids don't help in this case.

One authority has called the question of noise in industry the biggest single problem facing us today under the Workmen's Compensation Law. According to another authority, unless industry acts swiftly to protect itself against loss-of-hearing claims, it may be confronted with claims greater than those placed for silicosis, radium and smog cases combined. Compensation claims for occupational loss of hearing filed against a single company in N. J. amount to more than $5 million.

Benefits in various states for total loss of hearing range from $6,000 to $12,333 per individual. Claims filed throughout the U. S. are well up in the billions of dollars. The right to compensation by reason of an "occupational disease" is the basis for placing most of these claims.

Naturally, every industrial worker who suffers loss of hearing doesn't do so because of industrial noises. Yet since industrial noise can cause a hearing loss, courts award them benefits. There is also another angle to the problem. Loss of hearing seldom constitutes the loss of the ability to work at the job blamed for the damage. Yet many workers who have lost their hearing insist they can no longer do the job and make claims accordingly.

States are now working on legislation which will clarify the whole mess. But until effective laws are put into effect, industry has been advised to take the steps necessary to solve its own noise problem.

Frequently, some of the techniques used for reducing the noise transmitted to the surrounding community are also effective in protecting the worker. But in some cases they're not effective enough. For greater worker protection in noise-hazardous plant areas, specially designed ear plugs and helmets with built-in, ear-cushions are available.

Conclusion

Noise is a peculiar thing. Loudness is just one factor. Some relatively low-decibel noises are very objectionable; a squeaking piece of chalk for example. All this makes accousical engineering a specialized field and general noise problems are for the experts in this field.

Noise isn't just a nuisance, either; it can cost you money. Loss of efficiency of workers and lowered safety standards are minimum effects. The maximum effect of loss of hearing is tragic to the workman and a source of claims against management. Management has responsibility on both counts—so start thinking about it. Besides being a responsibility, it's good business too.

Matching Fuel Delivery To Turbocharged Performance

American Bosch's new injection pump controls moderate fuel delivery to compensate for intake manifold variations and for operation at varying altitudes.

NOW that turbocharged automotive diesels are running up and down mountains, problems are cropping up. Stationary engines are one thing, automotive engines another. If it's a stationary engine with natural aspiration, you figure the necessary derating factors and select the engine accordingly. If it's a turbocharged engine, you can match the turbocharger to the specific conditions.

But what do you do in the face of constant altitude changes? With this problem in mind, refinements in fuel injection equipment have been developed by American Bosch to give greater leeway in determining maximum engine rating.

The fuel injection pump and governor as a unit is a speed-sensitive metering device which delivers a specific fuel quantity in accordance with existing speed and load. The fuel-delivery characteristics of the pump are tailored to match engine full-load torque requirements. Maximum torque rating at any speed is limited by the available excess air which permits efficient combustion at any fuel delivery setting with acceptable smoke.

As air density decreases with altitude, the weight of air trapped in the cylinder is lower. Less fuel can be burned efficiently. When power requirements increase or power is reduced by poor combustion, the pump, controlled by the speed-sensitive governor, will increase fuel. You soon run out of air for efficient combustion and smoking starts.

Torque-limiting devices and mechanical smoke limit stops are commonly incorporated in the governor to limit maximum fuel delivery. However they have limitations in view of all the variables involved. For further improvement in maintaining smoke-free operation at varying air densities, an additional fuel delivery control must be provided.

Altitude Compensation

Density of air available for consumption by a normally-aspirated or mechanically-supercharged diesel decreases at about 3% per 1000-ft increase in altitude. To maintain the same combustion efficiency maximum output is derated proportionately with decrease in air density. Generally, maximum fuel delivery is reduced by 2 to 3% per 1000-ft increase in altitude, depending on the particular engine rating or local conditions.

Automotive units working at varying altitudes must be automatically derated to maintain maximum power at smoke-limit levels at all altitudes. One method is to automatically readjust the governor full-load setting to correspond with variations in altitude.

Fig. 1 shows an altitude-compensating device in which an aneroid bellows linked to an adjustable full-load stop gradually moves the stop plate toward "less fuel" as altitude increases. The bellows assembly can be provided with various preloadings to make the initial reduction in fuel delivery either at sea level or some higher altitude. Most engines usually have sufficient excess air available to permit operation up to 3000-ft without compensation.

The entire assembly including the adjustable stop plate is in an aluminum casting mounted on top of the governor in place of the cover.

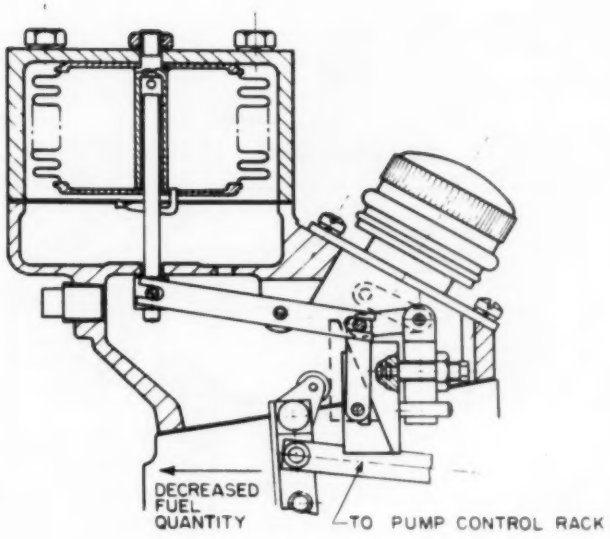
Compensating Turbocharged Engines

Compensation problems with turbocharged engines are somewhat different than those of normally-aspirated or mechanically-blown engines. Lag in turbocharger response due to rotor inertia can produce low manifold density conditions. Also, a form of altitude compensation is needed although for different reasons.

Manifold Density Compensation—Excessive exhaust smoke during acceleration of a turbocharged engine from idle or part loads at lower engine speeds is a problem. Either the engine speed range must be narrowed slightly, or a turbocharger that is well matched to the engine over the actual operating range of speeds and loads must be used. In this case it may be necessary to compromise with the smoke conditions at low speeds. Fuel savings and additional power from the same size engine makes the latter choice attractive to the customer and hence to the engine builder.

Another method of reducing exhaust smoke during acceleration is to tailor the maximum fuel delivery in relation to the turbocharger output at low speed. Normally, injection pump fuel delivery is a function of engine speed

Fig. 1 shows an altitude-compensating device in which an aneroid bellows linked to an adjustable full-load stop gradually moves the wedged shaped stop plate (shown by the dotted lines) toward "less fuel" as the altitude increases. The bellows assembly can be provided with various preloadings to make the initial reduction in fuel delivery either at sea level or some higher altitude. The entire assembly including the wedge-shaped adjustable stop plate is in an aluminum casting located on top of the governor.



and the delivery characteristic as controlled by the governor.

If a load is suddenly applied to the engine at idle or low-speed part loads, fuel delivery immediately increases to the maximum governed setting for that particular speed. The turbocharger output, however, is a function of engine power and the resulting lag of air delivery behind fuel delivery will reduce the air-fuel ratio below that required for a clear exhaust.

Since manifold pressure is a measure of blower output, it can be used as a means for controlling maximum fuel delivery in accordance with available air for combustion.

Fig. 3 shows a manifold pressure-operated device which automatically reduces maximum fuel delivery with reduction in manifold pressure. This unit, similar in construction to the altitude-compensator unit, consists of an adjustable full load stop operated by a diaphragm unit sensitive to manifold pressure changes.

Maximum fuel reduction is obtained when the diaphragm is held against its stop by the biasing spring. Increase of manifold pressure, measured in the cavity above the diaphragm, increases the full load fuel delivery to the normal setting required for the particular engine speed. The percentage decrease in fuel delivery at a fixed pump speed is governed by diaphragm travel. The range of manifold pressure through which compensation is affected is controlled by selection of a spring rate which correlates diaphragm travel and loading.

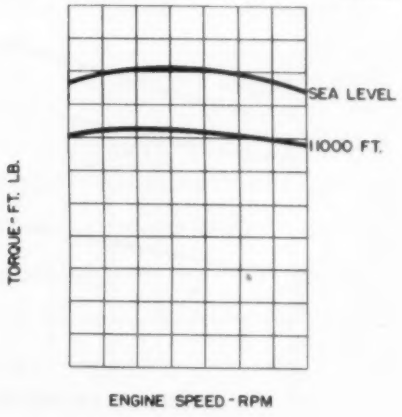
In Fig. 4 is shown a typical maximum fuel delivery reduction obtained with a compensating unit required to reduce smoke during acceleration of a turbocharged engine. Here the turbocharger output at part loads below 1200-rpm was insufficient to maintain proper air-fuel ratio for efficient combustion when engine load was suddenly increased.

Testing at various maximum fuel delivery settings at low speed operation showed that a 10% reduction in maximum fuel delivery, as manifold pressure dropped from 4-in. Hg. gauge to atmosphere, is sufficient to eliminate excessive smoke.

Road testing of the engine equipped with the compensating unit showed a marked reduction of exhaust smoke, but acceleration was reduced slightly.

Altitude Compensation—Altitude compensation with a turbocharged engine is required in certain applications

Fig. 2 shows the comparative torque curves of a typical normally-aspirated engine operating at sea level and the derated output of the same engine at 11,000-ft altitude which you can get when an altitude compensating device is used in system.



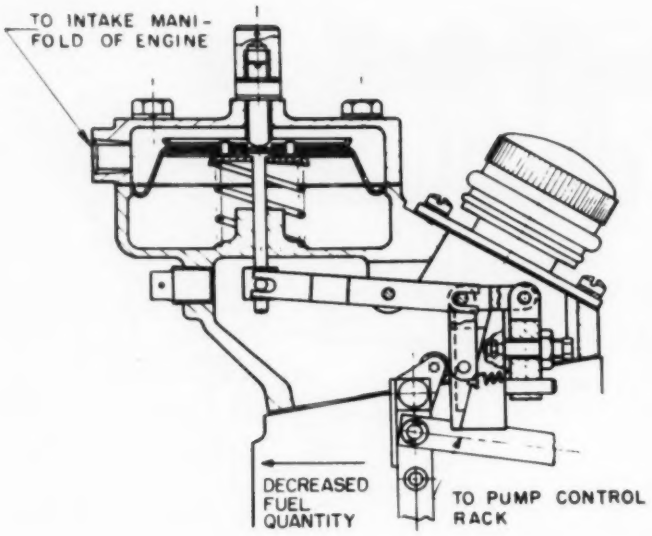


Fig. 3 shows a manifold pressure-operated device which automatically reduces maximum fuel delivery with reduction in manifold pressure. It consists of a wedge-shaped adjustable full-load stop operated by a diaphragm unit sensitive to manifold pressure changes. When diaphragm is held against its stop by spring, stop plate (dotted lines) is moved to left giving greatest fuel reduction. Increased manifold pressure acting on top of the diaphragm moves stop plate to right and permits increased full-load fuel delivery to the normal setting which is required for the particular engine speed.

although not for the purpose of maintaining smoke-free operation. The turbocharger tends to be self-compensating. Turbine speeds increase when air density is reduced. However, if a turbocharged engine attains maximum power with near maximum turbine speeds at sea level, reduced air density at higher altitudes would cause the turbine to overspeed and fail. The problem is strictly mechanical.

Maximum power output must then be limited by safe turbine operational speeds rather than by a smoke limit as in the case with normally-aspirated or mechanically supercharged engines. The percentage reduction will vary depending on operational characteristics of the turbocharger when matched with a particular engine.

A third control device which automatically reduces maximum fuel delivery with increased altitude and further reduces fuel at low manifold pressures to prevent smoking during rapid acceleration is shown in Fig. 5. This unit is similar to the manifold pressure device but has an additional aneroid bellows to provide altitude compensation.

During normal operation from sea level to approximately a 3000-ft altitude, the bellows unit is compressed against its internal stop by atmospheric pressure. The bellows unit then serves as a pivot point for the fulcrum lever connecting the diaphragm unit and adjustable full load stop. With manifold pressures above a specified minimum, the diaphragm assembly is held against its lower stop and the adjustable full load stop is raised to its normal maximum fuel delivery position.

During idle or part load when the manifold pressure is insufficient to balance the diaphragm spring, the dia-

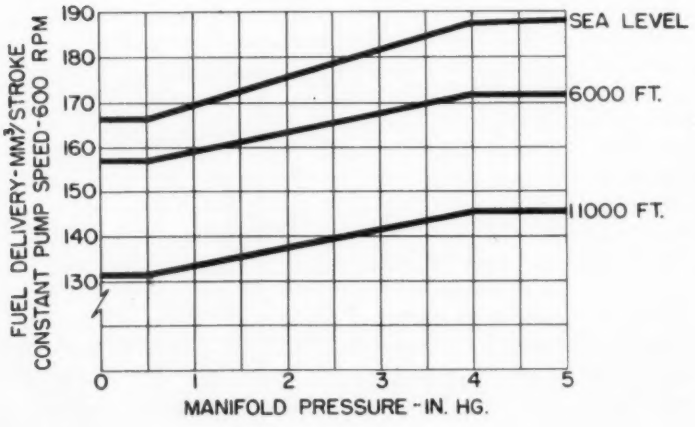


Fig. 4 shows a typical maximum fuel delivery reduction obtained with the compensating unit shown in Fig. 3 when used to reduce smoke during acceleration of a turbocharged engine. In this case, 10% reduction in maximum fuel delivery was necessary to eliminate smoke as manifold pressure dropped from 4-in. Hg. to atmosphere.

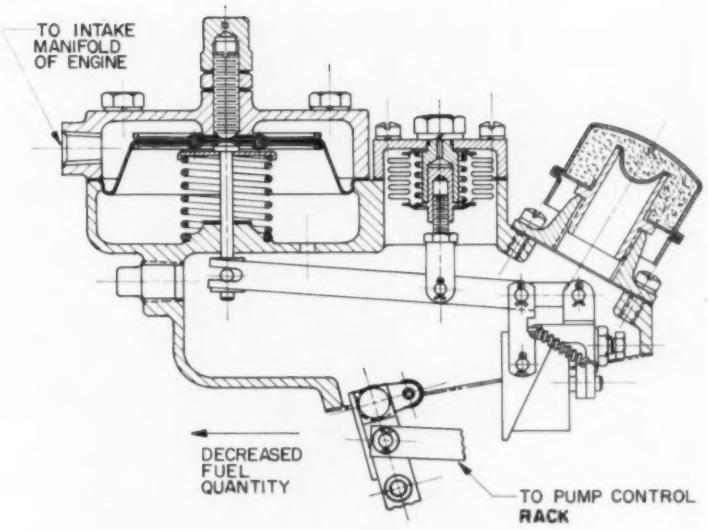


Fig. 5 shows a control device which automatically reduces maximum fuel delivery with increased altitude and at low manifold pressures to prevent smoking during rapid acceleration of turbocharged engines. The unit is similar to the manifold pressure device but has an additional bellows to provide altitude compensation. Atmospheric pressure holds bellows against its internal stop and serves as a pivot point for the fulcrum lever connecting the diaphragm unit (at left) to the adjustable full-load stop. Increased manifold pressures above a specified minimum will move diaphragm assembly against its lower stop, raising wedge-shaped adjustable full-load stop (at lower right) to its normal maximum fuel delivery position.

phragm moves upward and readjusts the full load stop. This reduces the maximum fuel delivery to a quantity which can be burned efficiently if load is suddenly applied. As manifold pressure increases with increased turbocharger output, maximum fuel delivery is increased gradually until full load delivery for that particular engine speed is restored.

With an increase in altitude, the bellows unit expands downward moving the adjustable stop plate to a reduced full load setting and relocates the pivot point for the diaphragm lever. The fuel reduction which takes place when manifold pressures are low, then becomes a percentage reduction of the maximum fuel delivery which has been compensated for altitude.

Fig. 6 shows the fuel delivery curves obtained at a constant pump speed of 600-rpm with combined altitude and manifold pressure compensation. Here a reduction in maximum fuel delivery of 3% per 1000-ft increases in altitude above 3000-ft was specified, with a further reduction of 10% between 0 to 4-in. Hg. manifold pressure.

Conclusion

Density controls for turbocharged engines are being field tested with satisfactory results. The above controls were developed to meet immediate needs of the engine and turbocharger manufacturer. Devolpment of controls for fuel injection equipment, which will give the ultimate in engine performance, will depend upon the close cooperation of the engine, turbocharger and fuel injection manufacturers.

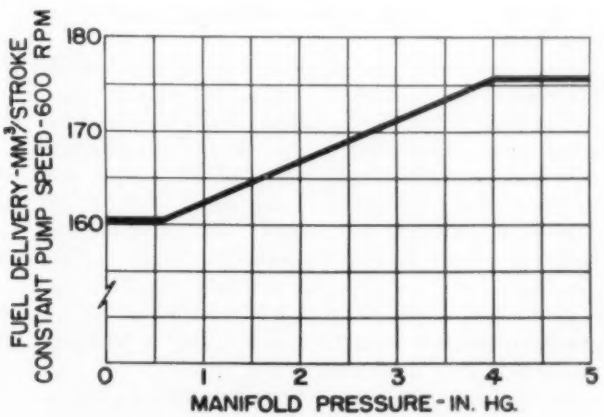
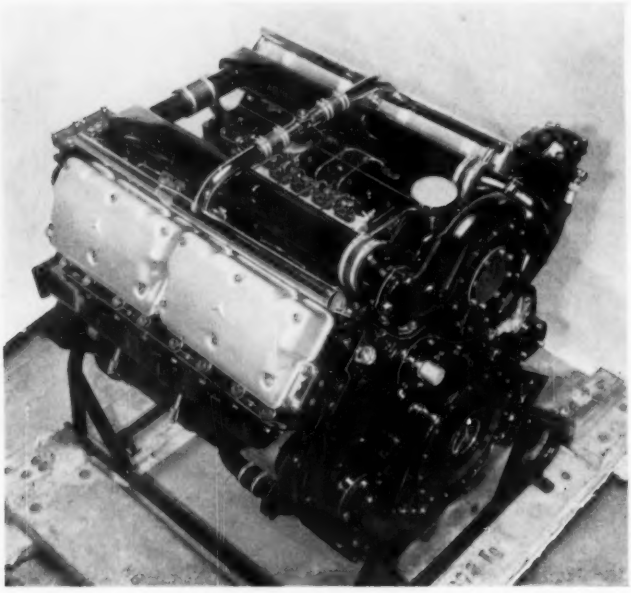


Fig. 6 shows the fuel delivery curves obtained at a constant pump speed of 600 rpm with combined altitude and manifold pressure compensation. Here a reduction in maximum fuel delivery of 3% per 1000 ft increase in altitude above 3000 ft was necessary with a further reduction of 10% at 0 to 4-in. Hg.



This new Mercedes-Benz, Model MB-837 diesel is rated 600 bhp at 2200 rpm. The 90-deg construction of the 8 cylinders permits the injection pump to be located deep in the vee so that short direct lines are used to injectors. Air intake and water discharge manifolds can also be seen inside the vee banks of cylinders. The two cylinder blocks per bank can also be seen with their cylinder heads and valve covers. Breather is at left of blower.

New Mercedes-Benz Diesel-600 hp, 3000 lb

Some details of a compact, lightweight and powerful newcomer to the Diamler-Benz AG. line of diesels.

GETTING more horsepower with less engine size and weight is apparently a universal objective. Evidence that it is a consideration in Germany was to be seen in the new Mercedes-Benz diesel, Model MB-837, first shown to the American public at the recent Motor Boat Show in New York.

Since weight and space considerations are important in this country for many engine applications, Diamler-Benz AG, builders of the Mercedes-Benz diesels, feels that engines stressing these features should have good acceptance here. This particular model is very light and compact for its power output. But judge for yourself.

Its rating is 600 bhp at 2200 rpm. The 8-cyl, 90-deg vee design produces a short, stiff engine. The design plus the neat placement of the manifolds and accessories gives the engine a square appearance that is substantiated by its overall dimensions. Length (engine only) is 49.2-in.; height is 42.2-in.; and width, 41.4-in.

Dry weight of this engine is 3000 lb which figures to 5 lb per hp. Extensive use of aluminum alloy engine components is a major factor in weight reduction. Another factor is the 75-hp output per cylinder.

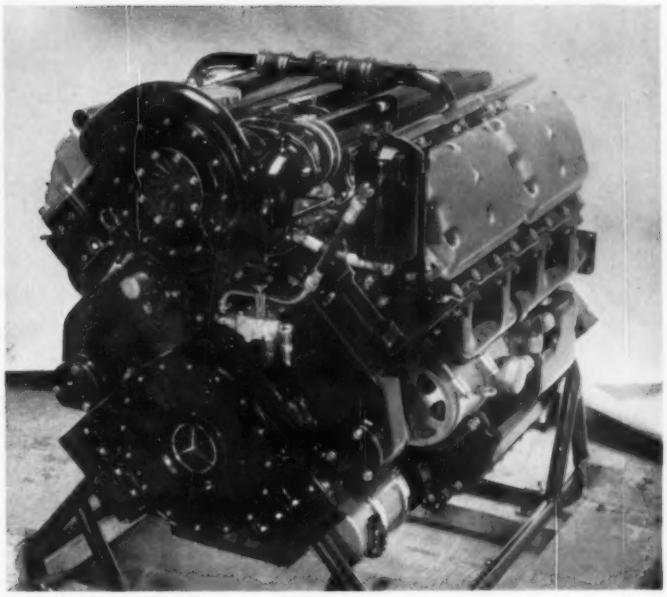
Bore and stroke are not quite square. Converted from metric measurement, the bore is $6\frac{1}{2}$-in. and the stroke figures to a shade over $6\frac{7}{8}$-in. At the 600-hp rating this puts the bmep at about 116.

Many Components are Aluminum

Starting up from the crankpan, major structural items are aluminum alloy castings. These include the crankpan itself, the engine block or frame, the cylinder blocks, heads, valve covers, gear train cover and the blower housing. Pistons are also aluminum alloy.

The major structural item is the engine block. It provides mounting for the hung-type crankshaft, twin camshafts, the cylinder blocks, and many accessory items. The gear train is mounted on its forward end.

Two aluminum cylinder blocks per bank, each mounting



Exhaust manifolds are angled down so that they do not protrude beyond basic engine. Accessories are also located so that they do not protrude beyond basic engine. Starter and generator can be seen tucked in under right cylinder bank, water pump and heat exchanger are tucked in under left cylinder bank. Individual cover plates give access to each drive for the two camshafts and the blower. Fuel transfer pump and filter can also be seen.

two liners, are used. Both the cylinder heads and valve covers follow the same pattern, two per cylinder bank.

Five-ring aluminum alloy pistons are used. The first of the three compression rings is chrome plated. The other two rings are for oil control.

The gear train provides accessory drives, drive for the two camshafts and for the centrifugal scavenging blower. While a major cover encloses all this mechanism, individual bolt-on cover plates are located to give access to each drive.

Other Components

Both the crankshaft and connecting rods are steel forgings. All bearing surfaces of the crankshaft are hardened. Steel-backed lead-bronze bearings of the precision type are used for both main and connecting rod crankpins. A side-by-side connecting rod arrangement is used.

Each bank of cylinders has its own camshaft. Cam lift is transmitted to the valves by a simple, rugged tappet, pushrod and rocker arm mechanism. With the camshafts moved outward from the engine centerline, plenty of space is provided in the vee for the fuel injection pump and the intake air piping.

Robert Bosch fuel injection equipment is used. The pump is the enbloc type with eight individual plunger and barrel assemblies. Injectors are located on the inner side of each bank and so short, direct high-pressure lines can be used.

Pressurized intake air is supplied by the single-stage centrifugal blower. The housing is of the double volute type, each outlet feeding one cylinder bank. A crossover pipe at the far end of the manifolds insures equal manifold pressures.

Systems

The combustion system features a precombustion chamber of proprietary design. This chamber is a steel insert in the aluminum alloy head. A special "burner" device is welded in its throat. Fuel is injected into the top of the chamber and a glow plug is mounted at the side to assist starting.

A pressurized lube oil system supplies oil to all moving parts. The crankpan is designed for dry sump operation. Oil circulation is handled by three service pumps and another pump pressurizes the system prior to starting.

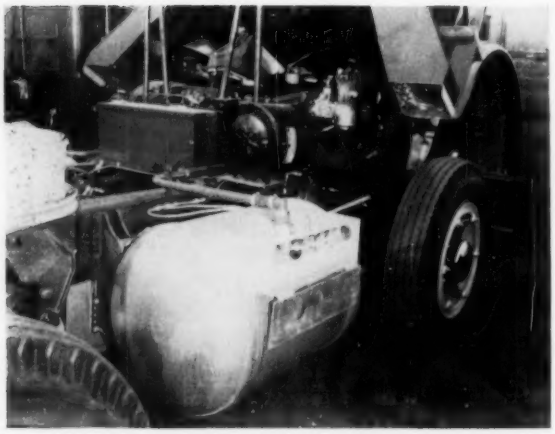
As to cooling, the engine was designed for a closed primary system. The engine illustrated was meant for marine service and so circulation of the primary water is through a heat exchanger by means of a centrifugal pump. Other arrangements are, of course, possible for other services.

General

The illustrations show that care was taken to see that maximum dimensions were dictated by the basic engine and not protruding manifolding, accessories, etc. Looking from the front, the Robert Bosch starter and generator were tucked in under the right cylinder bank. The same space on the other side houses the water circulating pump and the heat exchanger.

The fuel transfer pump, fuel filter and lube oil filters (at rear of engine) were located with the same idea in mind. Yet accessibility for servicing did not suffer.

All in all, it's a good looking engine and certainly provides a lot of power for its size and weight.



This photo, by courtesy of Mack Trucks, Inc., shows a typical truck LPG engine installation. The special propane tank with controls, air cleaner, carburetor and vaporizer are clearly seen.

What Lube Oil For LPG's?

By P. A. Binda— Research and Technical Dept.
The Texas Company—Beacon, N. Y.

Tests show that the proper lube oils must be selected for engines burning liquified petroleum gases if deposit and corrosion problems are to be avoided.

A GREAT deal of confusion exists concerning the lube oil requirements of LPG engines. Operating records and various published literature can easily give the impression that there are no lube oil problems. Also, that any oil can be used for extended periods or change periods can even be eliminated.

The reasoning is that better mixing with intake air occurs since the fuel is a gas. Plus the more complete combustion expected from this, it is also reasoned that even if there is incomplete burning, the unburned fuel and combustion products go out with the exhaust since they are in a gaseous state. It appears then, that there should be no engine deposits, no cylinder washing as experienced with diesel fuel and no crankcase lube oil contamination. But there is more to this than normally meets the eye.

A closer look at an operating engine and some actual tests give an entirely different picture. Look at the facts.

Low Temperature Engine Operation

Under stop-and-go driving conditions when an automotive engine does not have a chance to reach prescribed operating temperatures, undesirable engine deposits are formed. These originate primarily from combustion products that reach the crankcase. The lubricant is not exposed to high temperatures sufficiently to contribute to formation of engine deposits, particularly if the oil is either a highly refined product and/or inhibited against oxidation. Under this type of operation it is expected that LPG powering would not result in low temperature engine deposits.

A full scale engine was operated following a standardized laboratory engine test that simulates low temperture engine service. Commercial propane and a highly refined straight mineral oil were used. Freezing difficulties were experienced with the fuel vaporizer. At the end of the test, engine parts were free of significant amounts of deposit.

A well refined straight mineral oil adequately lubricated the engine. However, this type of operation can not be tolerated in LPG service. Sufficient engine coolant heat is not available to compensate for the refrigerating effect in the vaporizer, resulting in poor engine power performance.

Copper Lead Bearing Corrosion
(CRC-L-4 Tests)

	Commercial LPG		Gasoline, L-4 Fuel
Oil	Highly Refined Straight Mineral SAE 30	MIL-O-2104 Oxidation Stability SAE 30	MIL-L-2104A Oxidation Stability SAE 30
Cleanliness Rating			
Piston*	8.2	9.5	9.0
Overall**	90	90	89
Bearing Corrosion Grams/2 whole bearings	8.373	2.366	0.180
Neutralization No. increase	5.4	3.2	2.2
Viscosity SUS @ 210°F. increase	36	6.8	3

* 10 = Completely Clean
** 100 = Completely Clean

Results of laboratory engine tests show that a straight mineral oil would not be satisfactory in LPG heavy-duty engines. Some compounded lube oils might be found unsatisfactory.

High Temperature Engine Operation

Under high temperature engine conditions, heavy-duty field service, both fuel combustion products and lubricant contribute to engine deposits and bearing corrosion when corrodible bearings are used. Naphthene base oils under high temperature conditions increase rapidly in viscosity and form engine deposits. Paraffin base oils oxidize to form materials corrosive to engine bearings, particularly those of the copper-lead variety.

Laboratory engine tests were conducted following a standardized procedure which simulates some phases of heavy-duty service using an LPG powered engine. Some of the results are shown in the accompanying table. By using a highly refined paraffinic oil, engine deposits, particularly on pistons, and severe copper lead bearing corrosion were experienced. With a straight mineral naphthenic base oil, sufficient engine deposits would have been formed to either prevent appropriate evaluation of the results or to seize the engine.

A heavy-duty type oil, very satisfactory on gasoline engines, reduced piston deposits (which in the straight mineral oil test may have been due to both fuel and oil) but did not satisfactorily reduce bearing corrosion. Other heavy-duty high quality lube oils and higher detergency-level diesel engine oils have been found to be satisfactory in this test. It is obvious from these results that a straight mineral oil in LPG powered heavy-duty service engines would not be satisfactory. Some compounded oils might also be unsatisfactory.

Crankcase Lubricant Viscosity Increase

Normally, little or no crankcase dilution is encountered in LPG engines. Therefore, when the crankcase lubricant contacts hot engine parts, the lighter ends of the oil evaporate. The result is an increase in viscosity of the crankcase oil with use.

To maintain the crankcase oil viscosity recommended by the engine manufacturer, use one SAE viscosity grade lighter oil for makeup purposes. The same type of oil as originally used in crankcase should be used for makeup.

Crankcase Contamination—Abrasive

The best maintained engines accumulate abrasive materials such as dirt, dust and wear metals which oil filters do not completely remove. These contaminants increase the wear rate of engine parts thereby shortening engine life. The best way to remove these undesirable materials is by changing oil periodically, preferably while the oil is hot and as soon as possible after the engine is shut down.

Crankcase Oil Recommendation

From the above data, it is obvious that even the highest quality straight mineral oils are not satisfactory for LPG powered engines under all conditions of operation. For best operation Supplement I quality oils should be used. But there are many applications where the lower detergency heavy-duty quality oils will perform with complete success. There does not seem to be a need for higher quality oils than Supplement I in automotive LPG's.

None of the major LPG equipment manufacturers are recommending straight mineral oils for their engines. Most recommendations are for API service designation MM or MS and MS or DG for heavy duty service. Some designate MIL-L-2104A quality oils.

Conclusion

LPG appears to be closely related to gasoline, yet its nature and characteristics are such that for best performance and use of the fuel an engine specifically designed for LPG should be used. There are many engine applications however, where a properly converted engine lets the operator benefit from some advantages of LPG.

As in other engines, LPG engines should be properly maintained and lubricated with sufficiently high quality lube oils to obtain maximum engine life.

What Do You Know!

Here are some questions to test your general knowledge of the diesel field. Make your selections, then turn to Page 76 to check them.

1. It is possible and often practical to burn liquid and gaseous fuel together in small industrial and automotive diesel engines.
   a. True b. False

2. A common reason for smoking of turbocharged truck engines when accelerating is that:
   a. Earlier load-up with fuel is being cleared out.
   b. Increase in air delivery lags behind increased fuel delivery.
   c. Engine is being overloaded.

3. Ideally, fuel delivery characteristics for a turbocharged truck diesel operating in mountainous country should be modified for:
   a. Altitude.
   b. Manifold density condition.
   c. Engine Speed.
   d. Engine Load.

4. Since in LPG engines, better mixing with intake air occurs and combustion is cleaner because the fuel is a gas, any lube oil is adequate.
   a. True b. False

5. Testing a drop of used lube oil on a special blotter-type paper gives an idea of:
   a. The viscosity of the oil.
   b. How dirty the oil is.
   c. How dispersancy additives are holding up.

6. No. 6 fuels can be burned efficiently in medium-speed engines at high loads. But below certain intermediate loads one of the following affects thermal efficiency.
   a. Viscosity.
   b. Cetane.
   c. Sulfur.
   d. Flash point.

The Simplex oil testing kit made by Lengor includes a thief pump, for withdrawing samples; a permanently mounted viscosity comparator for checking fuel oil dilution; special blotter paper and "Solid Contaminants Chart" for checking amount of fuel soots and insoluable particles; and a reagent, vial and color chart for checking whether a lube oil sample is neutral or acid in condition.

Kit For Lube Oil Field Testing

The tools and procedures are simple; it's the interpretation of results that count. Here are details of a test kit and ideas on interpretation.

FIELD tests for evaluating lube oil condition are growing in popularity. Part of this is due to a growing recognition that recommended oil change periods do not necessarily apply to all engines, even of the same make. Type of service and engine condition are two items, for example, that can make the engine builder's oil change period too short—*or too long*.

Another advantage of periodic field testing is that it can be an effective preventive maintenance tool. Records of tests made will establish patterns of contamination buildup. Variation from the norm is an early indicator of trouble.

Field men are not lab technicians and so the success of a field testing program may depend on simplicity of testing. Fortunately, the mechanics of testing for a few of the major indicators of oil unfitness are simple and yield to rough checks on a "go-no go" basis.

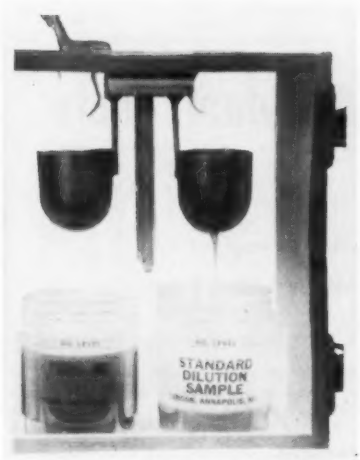
Simple equipment, and we plan to discuss one such kit, is available. Field tests are generally concerned with the three most harmful contaminants—fuel dilution that can reduce the oil's viscosity to unsafe limits; solids that cause abrasive wear and may form deposits; and excessive corrosive acidity.

The Simplex oil testing kit made by Lengor, Annapolis, Md., provides the tools to check these three indices of lube oil contamination. Tests are made on a comparison basis. With viscosity comparator, the viscosity of the test sample is compared with a mixture of new oil diluted with the maximum amount of fuel to be tolerated.

Test sample and the control mixture are placed in jars side by side. Temperatures are allowed to stabilize. Two identical cups with identical orifices are lowered into the liquids, filled and withdrawn. The lower the viscosity, the faster the flow and with a little experience it is possible to judge how close the sample is approaching (or whether it has exceeded) the maximum dilution limit.

The amount of solids—fuel soots and insoluable particles—are judged by the "blotter" technique. A drop of the sample is placed on a special paper and color of the spot is compared with a "Solid Contaminants Chart". An idea of how dispersancy additives are holding up can be obtained, by noting how effectively materials in suspension are carried toward the outer edges of the spot. Fairly even color, carried pretty well out to the edges, indicates satisfactory levels.

Comparison of the spot color with the chart gives an indication of the relative contaminant load. Concentration of color at the center of the spot indicates a dispersive



When using this viscosity comparator, identical cups with identical orifices are filled with test sample and control mixture at same temperature. Flow speed is then compared.

deficiency and signals an oil change. Presence of any gritty material is a clear indication that the oil should be dumped and filter elements changed.

Acidity tests are made by combining a measured amount of the oil sample with an equal amount of a reagent. These are placed in a vial and shaken to mix thoroughly. The color is then compared with a chart provided with the kit. Blue is on the neutral side while acidity is shown by shades ranging to yellow.

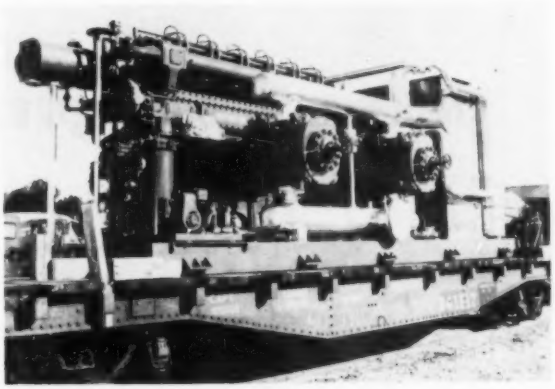
All necessary items for the tests, including a thief pump for withdrawing samples from the engine, are included in the kit. They are housed in a metal box in which the viscosity comparator is permanently mounted.

While the tools and procedures for making these rough field tests are simple, the big problem lies in interpretation of the results obtained in terms of your particular engines, type of service and the oil used. It's like use of a "go-no go" gauge in the machine shop. It will tell you if your piece is up to par or not but only after a lot of work and testing has decided what is "par".

Standards for your equipment must be determined. Experience will help. More elaborate testing, perhaps performed with the help of your oil supplier, will help establish control levels for the various contaminants.

Once you have set up the limits that suit your operation, you should insure that tests are made periodically and that the results are recorded. If you can spread out an engine's lube oil history over a reasonable period on your desk, you can do a better interpretive job. Correlate it with the engine's maintenance record too to be sure that you are not kidding yourself.

It is a good idea to run backup tests occasionally to make sure that the field test standards are still valid. Things may change—operating conditions, new engines or lube oil, etc. With this sort of program the simple field tests can be an effective control for both lube oil evaluation and preventive maintenance.



This 6-cyl Worthington gas-engine compressor is pumping gas from 25 wells to one of Northern's main line stations at Hugoton.

Worthington's New Turbocharged Gas-Engine Compressor

A NEW turbocharged gas-engine compressor known as the SLHC has been developed by Worthington Corp. engineers. The unit is available in sizes ranging from 330 to 880 horsepower. According to the Worthington Corp., it is the only gas-engine compressor in this size that has been turbocharged.

The turbocharger gets all its energy from otherwise wasted exhaust gas and compresses intake air to the pressure necessary for cylinder charging. This results in greater power with lower weight per unit of space giving greater portability as well as economy for any size unit. These benefits apply to permanent installations, as well.

According to Worthington, this greater output per pound and compactness has resulted in lower costs for building, installing, and moving the units.

After five years of research and field testing, the first of these units is now in operation in a field gas-gathering station of the Northern Natural Gas Company at Muncie, Oklahoma. This 6-cyl, unit is pumping gas from 25 wells to one of Northern's main line stations at Hugoton, Kansas.

The SLHC gas-engine compressor is designed for pipeline distribution service; natural gasoline plants; pressure maintenance in oil fields; oil refinery operations such as vapor recovery, re-cycling and stabilization of gases; refrigeration systems; and in the petrochemical industry where various processes require the use of gas under pressure.

The SLHC can also be built to serve as either an air compressor for general plant air supply or as a basic refrigeration compressor.

Five SLHC sizes are available in 4, 5, 6, 8, and 10-power cylinder combinations. All are of the in-line design. Higher ratings are offered where the turbocharging air can be after-cooled by water which is colder than can be provided by a radiator. This is possible in many permanent plant installations.

Medium-Speed Engines Can Burn Residual Fuels

A report on techniques developed to cut fuel costs in railroad-type engines by using residual fuel at high load and residual-distillate blends tailored to suit other operating conditions.

SUBSTANTIAL reduction in operating costs has powerful attraction. It is the incentive that has spurred considerable research into ways and means to extend the use of residual fuel in medium and high-speed diesels, particularly in railroad and marine service.

Where fuel represents a high percentage of operating cost—for example, it's 50% or more for a locomotive in heavy freight service—considerable saving is possible. It will well offset the cost of extra equipment and any moderate increases in maintenance costs.

Residual fuels have been the diet of many large, slow-speed diesels in marine and stationary service for years. In some cases, the residual fuels were all that was used; in others, distillates were used for starting, part-load maneuvering (in marine service), and before stopping.

Smaller engines in the medium and high-speed class give evidence that their digestion of the No. 6 fuels is not so good. Yet where fuel is a major cost item, the differential in No. 2 and No. 6 fuel costs is great enough to permit attractive savings when these fuels are blended in varying proportions to meet the engine's requirements. Naturally, the higher the percentage of No. 6 used, the higher the savings.

Recent developments which may enable these engines to use a wide range of residual fuels are discussed in a Society of Automotive Engineers paper entitled "Dark Diet For Diesels". This was presented by G. L. Neely, S. F. Griep and P. L. Pinotti, all of the Product Engineering Dept. of Standard Oil Co. of California.

For years this company investigated methods for successfully using residual fuels in medium and high-speed diesels. Methods were developed to remove solids, oil field brines, and water from the fuel. Means of heating fuel to get proper viscosity at the injector for good atomization were also devised. But no matter what was done, piston ring and cylinder liner wear increased over normal wear with distillate fuels.

These studies also indicated the inadvisability of operating medium and high-speed diesels at idle or part load on residual fuels alone. Abnormal engine deposits occurred with attendant difficulties. However, these troubles were not experienced to the same degree under higher-load operation.

Two-Fuel System Needed

Test results showed a need for the use of distillate fuel at idle or part load. At higher loads, performance on residual fuel was satisfactory.

A "selector" system was one approach. Either type of fuel could be selected on the basis of load conditions. A better system, however, was a "fuel blender" that was developed to automatically blend residual fuel with the distillate to provide the viscosity characteristics at the injectors needed for each engine's power condition.

The advantage of the blender system is the nicety with which it matches the engine's viscosity needs throughout the operating range. This means that a maximum safe amount of residual fuel is used at all times.

Test Set-Up And Objectives

Specific data as to how well certain engines could digest "Dark Diets" was obtained from short-term performance standing tests of railroad-type 2- and 4-cycle diesels. The engine's power output was absorbed by a loading device. Fuels used were ASTM No. 2 distillate, ASTM No. 6, and blends of the two. Specifications of these two fuels follow:

	ASTM No. 2	*ASTM No. 6*
Flash, °F	175	220
Viscosity At 100°F, SSU	37-39	6000-7400
Ash, o/o	*None*	0.04
Sediment & Water o/o	*Trace*	0.2
Pour °F	—5	+30
Carbon Residue, o/o	0.002	14-17
Sulfur, o/o	0.40-0.95	0.90-1.30
Distillation °F		
ST	360	—
10%	450	—
50%	526	—
90%	600	—
EP	675	—

These tests were made to determine: (1) most favorable operating conditions; (2) changeover point, based on power output, from distillate to residual fuel; (3) engine ability to use residual fuels of various viscosities throughout operating load range, as measured by thermal efficiency and exhaust smoke.

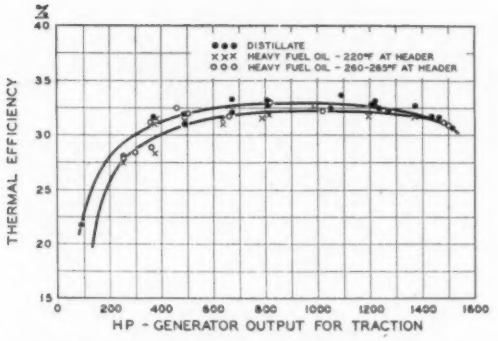

%
THERMAL EFFICIENCY
●●● DISTILLATE
XXX HEAVY FUEL OIL - 220°F AT HEADER
○○○ HEAVY FUEL OIL - 260-265°F AT HEADER
HP - GENERATOR OUTPUT FOR TRACTION

Fig. 1 shows the relation between the thermal efficiency and generator output for traction of a 4-cycle engine when using No. 2 and No. 6 fuels. Thermal efficiency at high load is comparable for either fuel but it drops as load decreases when using No. 6 fuel.

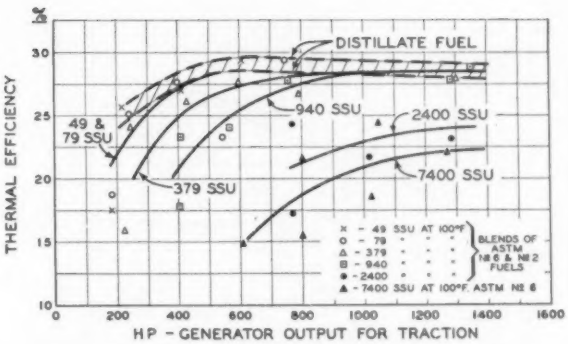


Fig. 3 shows relation between thermal efficiency and generator output for traction of a 2-cycle engine using various blends of ASTM No. 6 and No. 2. As load drops, percentage of No. 6 in blend necessary to give No. 2 thermal efficiency is reduced.

Observations of Four-Cycle Engine Test Data

Figs. 1 and 2 are indicative of comparative engine performance on distillate or on residual fuel. Thermal efficiency at high load on either fuel is comparable. But on No. 6 fuel, thermal efficiency drops as engine load decreases. Peak cylinder pressures and exhaust temperatures compare well regardless of the fuel.

Exhaust smoking above 25% load was comparable using either fuel. Below this point when using No. 6 fuel the smoke meter trace changed from black to brown, indicating that unburned fuel was being emitted from the exhaust stack.

Ignition delay, as would be expected, was greater throughout the load range with the No. 6 fuel. Maximum difference occurred at about 25% load.

During the testing with residual fuels, two header temperatures were used (see Fig. 1). It was found that increasing temperatures above 220°F had no apparent effect on engine performance.

Observations on Two-Cycle Engine Test Data

Tests run with the 2-cycle engine envolved various blends (indicated by viscosity) of No. 6 and No. 2 fuels, plus a straight No. 6. Some results are shown in Figs. 3 and 4.

Greater tolerance for No. 6 fuel is shown in high load than at intermediate and low loads. At the high loads the engine will deliver its power with a 1000 SSU at 100°F. blend of Nos. 6 and 2 fuels. The percentage of No. 6 that can be utilized with thermal efficiencies comparable with No. 2 fuel is reduced as loads decrease.

Fig. 7 shows the effect on brake specific fuel consumption (BSFC) of different load factors for four of the blends used in testing. Section D shows this clearly. The effect of time, attributed to progressive injector tip fouling, is evident.

This data suggests that carbon "horns" or "trumpets" are formed on injector tips when operating at reduced loads on blends of Nos. 6 and 2 fuels. These horns may break off and reform even when operating with a 49-SSU blend (Section A). Atomization and spray pattern is disrupted by these horns, resulting in smoking and lowered thermal efficiency.

Exhaust temperatures and peak cylinder pressures, (Fig. 5 and 6), compare favorably with those observed when operating with No. 2 distillate alone.

Fig. 2 shows the relation between peak cylinder pressure and exhaust temperature versus generator output for traction of a 4-cycle engine using No. 2 and No. 6 fuels. These pressures and temperatures compare well regardless of the type of fuel used.

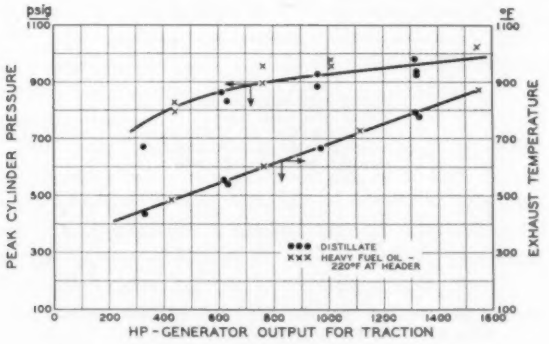
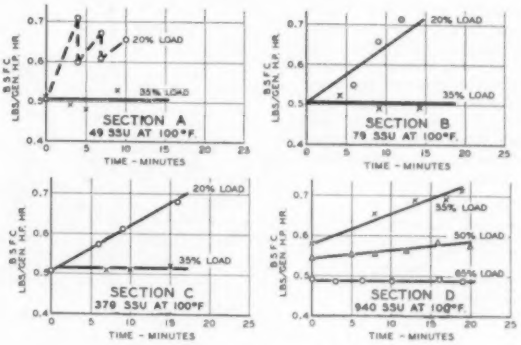


Fig. 4 shows relation between engine performance and time for various loads and fuel blends. Data from these curves show that fuel consumption and fouling of injector tips is increased when operating at reduced loads on blends of No. 6 and No. 2 fuels.



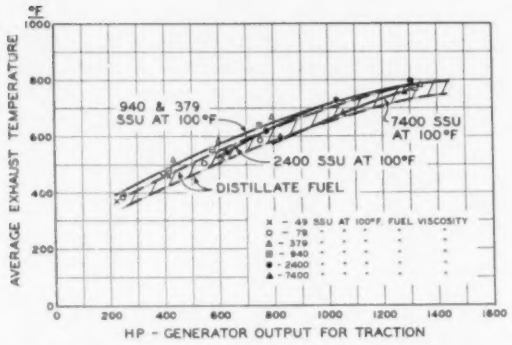

AVERAGE EXHAUST TEMPERATURE
°F
940 & 379 SSU AT 100°F
7400 SSU AT 100°F
2400 SSU AT 100°F
DISTILLATE FUEL
X - 49 SSU AT 100°F. FUEL VISCOSITY
HP - GENERATOR OUTPUT FOR TRACTION

Fig. 5 shows the relation between exhaust temperature and generator output for traction of a 2-cycle engine using distillate and residual fuels. Exhaust temperatures compare favorably with those obtained when operating with No. 2 alone.

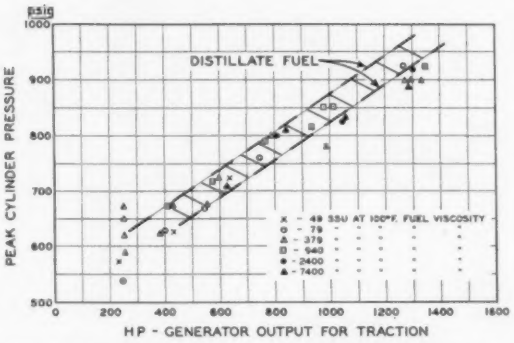


Fig. 6 shows the relation between peak cylinder pressure and generator output for traction of a 2-cycle engine using distillate and residual fuels. Peak pressures compare favorably with those observed when operating on No. 2 distillate alone.

Other Approaches to Residual Fuel Use

Realizing the complication of duplicate storage and dispensing facilities, etc., inherent in a two-fuel system, attempts were made to find a way to utilize a selected residual fuel under all operating conditions without recourse to distillates. Three areas were explored.

Additives in the Fuel Stream—Cetane improvers, combustion accelerators, moisture, and volatile hydrocarbons were tried. Improvements in thermal efficiency at 25% load were nil.

Additives in the Air Stream—Steam, a portion of the exhaust, liquified petroleum gas and other volatile hydrocarbons were introduced in the intake air. Again, results at 25% load were unnoticeable.

Engine Operation—The engine was split (four cylinders firing) to increase individual cylinder loads; intake air was heated; and injection pressure increased by plugging three of the six injector holes. Only the latter showed any results.

While the critical load threshold was lowered from 25% to 10% before engine fouling was observed, the need for distillate fuel under idle conditions was not eliminated. Operation below 10% loads was not satisfactory with the 379-SSU blend using the modified injectors.

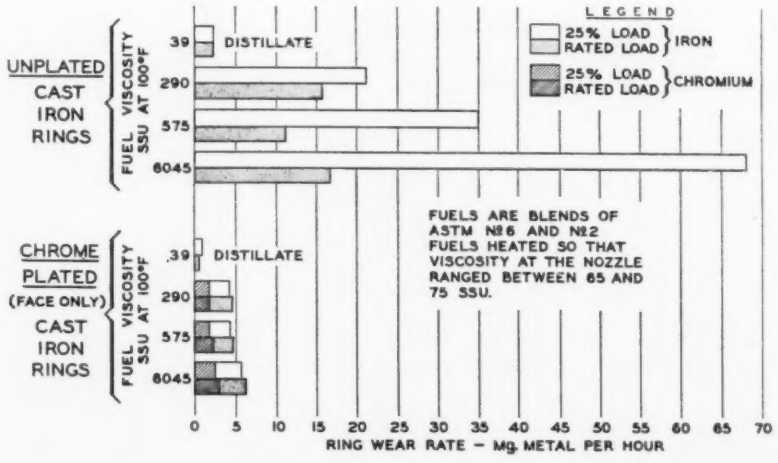
Even if injectors could be made to use this residual fuel at idle and also be suitable for full load operation, it was felt that a two-fuel system would still provide further economies. Also, distillate fuel is desirable for other reasons, including purging of lines when shutting down and for starting and warming-up periods.

Engine Deposits and Wear

When using residual fuels, wear of bare cast iron liners and rings was found to increase two to threefold over normal wear rates when using distillate fuel. Data showing the effects of fuel type, operating conditions and chromium plating on piston ring wear is shown in Fig. 7. This was obtained in the laboratory using the radioactive piston ring technique.

Note that with this particular engine, increasing the

Fig. 7 shows the effect of chromium plating and load on wear for distillate and residual fuels. Data was obtained by using radioactive piston rings in a 4-cycle engine. Increasing the percentage of residual fuel increased wear rate on cast iron rings and liners at light loads. Chromium plated rings reduced wear.



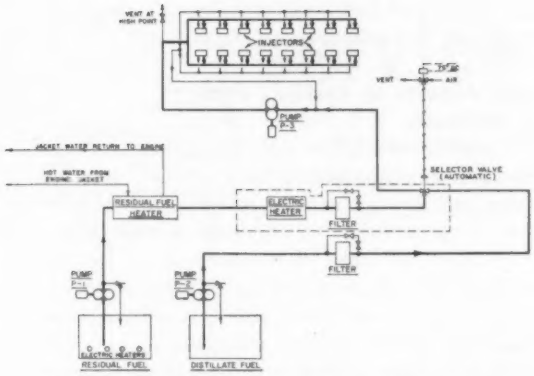


Fig. 8 shows a diesel fuel selector system. This is an "on-and-off" arrangement which automatically changes the supply from a distillate fuel required at low loads to a selected residual which gives satisfactory operation at high loads.

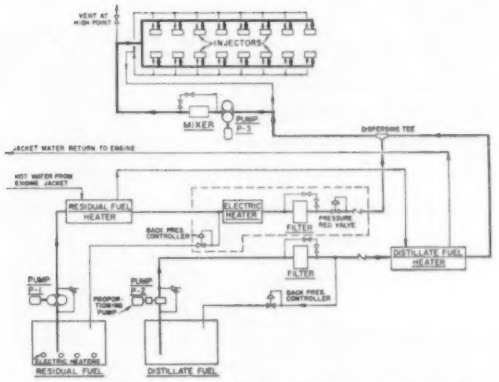


Fig. 9 shows a diesel fuel blender system. It continuously supplies preselected quantities of distillate fuel for idle and light loads and automatically furnishes residual fuel to supplement the distillate according to the power demands.

percentage of residual fuel increased the wear rate at light loads when using bare cast iron rings and liners. However, at high output, although the wear rate was higher when residual fuel was used, increasing the percentage had no effect.

Chromium plated rings reduced wear drastically. Also, engine load had no marked effect as in the case of bare rings. This suggests the importance of metallurgy in liners and/or rings in reducing wear obtained with residual fuels.

Two-Fuel Systems

In view of current engine designs and the present state of the art of burning residual fuels it was deemed that two-fuel systems offered the best possibility of getting satisfactory performance. Therefore, work progressed on this basis.

Basic requirements for a two-fuel system are: (a) residual fuels should be run-of-the-mill, heavy commercial grades; (b) heaviest residual fuel with minimum added distillate fuel, consistent with satisfactory operation, should be supplied for each load condition; (c) no requirement that residual fuels be fully compatible with distillate fuel used; (d) increased maintenance costs due to the use of residual fuels should be minimized.

The Fuel Selector System, Fig. 8, is an "on-and-off" arrangement which automatically changes the supply from a distillate fuel required at low loads, to a selected residual fuel which gives satisfactory operation at high loads. This is done at a predetermined load point, generally between 4th and 5th throttle position. As load is reduced to the changeover point, all-distillate fuel is again supplied.

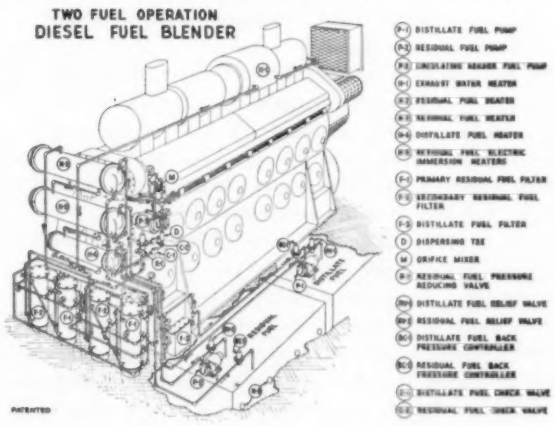
This system fails to comply with (a) and (b) basic requirements for a two-fuel arrangement in that the residual fuel must be low enough in viscosity to give continued safe operation in medium throttle positions. This prevents taking advantage of the heaviest, cheapest fuel which the engine can use at maximum load. And it is under this condition that the greater volume of fuel is consumed. Use of more viscous residual fuels increases the possibility of adverse performance at medium loads.

Regardless of the "selector" system disadvantages, its operation is satisfactory enough so that one large railroad has applied it to 50 locomotives, and at least one other is making road tests.

The Fuel Blender System complies more fully with the basic requirements for a two-fuel system. It continuously supplies preselected quantities of distillate fuel for idle and light-load operation. When engine fuel demands exceed this quantity, the device automatically furnishes residual fuel to supplement the distillate, thereby increasing the proportion of residual to distillate according to power demands.

This system, Figs. 9 and 10, uses two primary fuel pumps. One is a distillate fuel pump of fixed capacity to supply fuel at idle and low loads. As fuel requirements rise with load increase, pressure in the fuel system is reduced. Then the other pump supplies residual fuel as necessary to meet engine demands.

Fig. 10 shows how the diesel fuel blender uses two primary pumps. One is a distillate of fixed capacity for idle and low loads. The other pump supplies residual fuel as needed to meet engine demands.



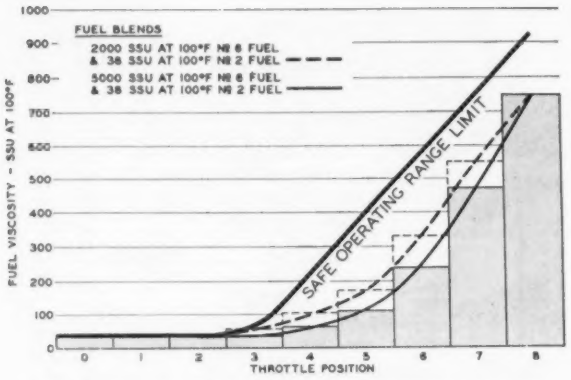

FUEL BLENDS
2000 SSU AT 100°F NO 6 FUEL & 38 SSU AT 100°F NO 2 FUEL
5000 SSU AT 100°F NO 6 FUEL & 38 SSU AT 100°F NO 2 FUEL
SAFE OPERATING RANGE LIMIT
FUEL VISCOSITY - SSU AT 100°F
THROTTLE POSITION

Fig. 11 shows the ability of a blender system to supply a more viscous fuel as the load increases, without sacrificing thermal efficiency. Fuels whose viscosities exceed those of the safe operating-range line, defeat purpose of using residual fuels.

This automatic fuel blending is accomplished by action of the two pumps, plus the necessary relief valves and pressure controllers in the distillate and residual systems. A circulating pump in the fuel header acts as a mixer.

A circulating pump is used in the fuel header of both the "selector" and "blender" systems. In-as-much as the fuel-return lines from the injectors are connected to this pump's suction, the fuel header becomes a circulating one. This arrangement meets incompatibility problems which become more critical as viscosity of the blend is reduced.

About two quarts of residual fuel, (enough to last 10 minutes at idle) remains in the circulating header whenever the engine drops quickly from full load to idling. At this time, fuel viscosity would be, say, 750 SSU, but would be rapidly diluted by the distillate. This does not appear to introduce operational problems provided the least possible header volume is used.

Practical Fuel Blender Operation

Ability of blender system, to supply a more viscous fuel as the load increases, without sacrificing thermal efficiency, is shown in Fig. 11. The heavy line curve (Safe Operating Range Limit) is based on data similar to that shown in Figs. 3 and 4.

When the engine is operated at a viscosity above and to the left of the safe operating range curve, performance will eventually become unsatisfactory due to drop in thermal efficiency and other factors. Thus, fuels whose viscosities exceed those of the safe operating-range line, defeat the purpose of using residual fuels.

Viscosities produced by the blender for the various throttle positions closely parallels the safe operating range, providing a consistent factor of safety throughout the entire zone of operation on residual fuel. Actually the blender could be arranged to match the safe operating-range curve. However, this eliminates the safety factor felt necessary to guard against variations on engines, operation and fuels that could modify the shape and location of the safe operating-range curve.

Economic Aspects of Residual Fuel Use by Railroads

Other problems which deal with satisfactory performance of engines using residual fuels without incurring undue costs are being evaluated under actual railroad operation. These include: (a) two-fuels storage at terminals; (b) two fuel tanks on locomotives; (c) heating residual fuels to facilitate pumping; (d) additional filtration requirements and costs; and (e) additional engine wear, particularly of rings and liners.

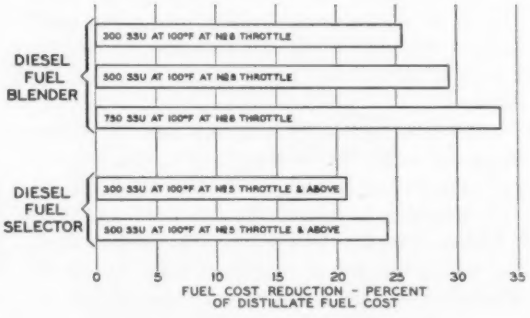
With the exceptions of item (e), these problems seem of minor economic importance in relation to potential savings in fuel cost. A portion of savings attainable are lost in increased engine maintenance. These additional operating costs are not known. However, computed data showing cost reduction possible with both the selector and blender systems as a percent of costs with conventional distillate systems is shown in Fig. 12.

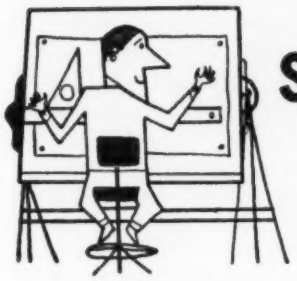
The greater savings with the blender system are under operating conditions which provide a substantial safety factor for all load conditions. The greater the percentage of residual fuel, the greater the saving. Actually this system, with these particular fuels, would permit operating this engine with up to 1000-SSU blend fuel at the No. 8 throttle position, thus providing greater fuel economies than illustrated.

Net savings will depend on the cost and properties of the distillate and residual fuels available in various localities, the increase in maintenance, and other costs including the fuel required to heat the residual fuel.

The problem of wear in engines using residual fuels and its effect on net operating economies is being investigated. Additional operating costs encountered with the two-fuel system, such as heating and filtration, are not expected to disturb the savings indicated for use of the blender system over diesels using distillates. This holds true even at present levels of wear and at present prices of residual and distillate fuels.

Fig. 12 shows a comparative reduction in fuel cost when using a diesel fuel blender or a diesel fuel selector. This is shown in percentage of conventional distillate fuel system costs.


DIESEL FUEL BLENDER
300 SSU AT 100°F AT NO 8 THROTTLE
500 SSU AT 100°F AT NO 8 THROTTLE
750 SSU AT 100°F AT NO 8 THROTTLE
DIESEL FUEL SELECTOR
300 SSU AT 100°F AT NO 5 THROTTLE & ABOVE
500 SSU AT 100°F AT NO 5 THROTTLE & ABOVE
FUEL COST REDUCTION - PERCENT OF DISTILLATE FUEL COST



service section

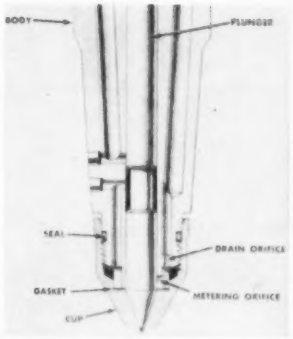
Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you

Cummins PT Injector Bodies

In the PT injector, the proper relative positions of the groove on the plunger and the metering orifice must be maintained. Do not reface the gasket end of the injector body, and do not lap the plunger to its seat in the cup.

Both of these operations interfere with fuel metering by changing the relationship of the groove on the plunger with the metering orifice. Removing material from the end of the body raises the plunger in its seated position; lapping the plunger in the cup has just the opposite effect.

If both reseating operations could be performed to the right degree it would be possible to balance one against the other. But the dimensions are so critical that they should not be attempted in the field.



Cat's 24-V Starting System

The 24-v, direct electric starting systems have been generally accepted as an effective method of starting Caterpillar diesels used in track-type Tractors, Motor Graders, Traxcavators and wheel Tractors. Voltage is provided by batteries, connected in series, producing 24-volts while temperatures in the precombustion chambers are raised to effect combustion by glow plugs at 1800°F.

Starting the diesel on these units with only the 24-v direct electric starting system can be accomplished at a temperature as low as 32°F.

The limitation of 32°F does not mean that starting cannot be accomplished at lower temperatures. But, since storage batteries are the sole source of cranking effort, the 24-v system alone is not dependable at lower temperatures.

To further reduce the starting limitations of the glow plugs and batteries and increase the reliability of starting at temperatures lower than 32°F ether starting aids have now been made available. Combination of glow plugs and ether aids provides a quicker start at temperatures between 10° and 32°F.

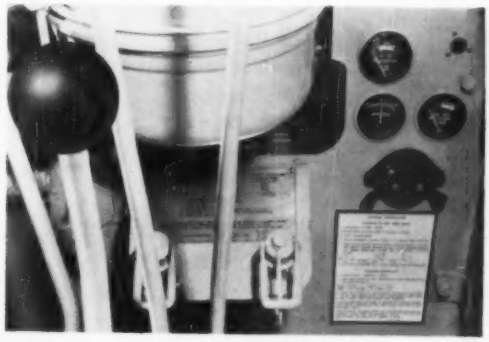


Photo at left shows glow plug at upper left in passage leading into precombustion chamber. Photo at right shows twin ether aids in center, heat switch under gauges.

For most satisfactory starting results, these two starting aids, glow plugs and ether, should be used together in accordance with the accompanying chart.

When the temperature is below 32°F and it is necessary to use ether starting aids, follow this procedure:

1) Move the heat switch to "ON" position for the length of time indicated in the following chart.

2) Discharge the required number of ether capsules.

Starting Temperature Range	*Glow Plug Heating Time (Heat Switch On)*	*Number Of Ether Capsules To Use*
Above 60°F	None	None
45° to 60°F	45 Seconds	None
32° to 45°F	1 Minute	None
20° to 32°F	2 Minutes	1 Capsule
10° to 20°F	2 Minutes	2 Capsules

Service Section

(*Continued from Page 55*)

New Fuel Inlet Connection Check Valve Spring for Cummins L & LR

A new fuel inlet connection check valve spring, Part No. 100664, is being used in all L and LR engines after engine serial No. 127792.

The new spring allows the check valve to open at 35 to 45-psi instead of 100 to 110-psi as required with the former 8520-1 spring. The new spring is helpful in reducing engine speed fluctuations which have been noticeable in a few generator set applications.

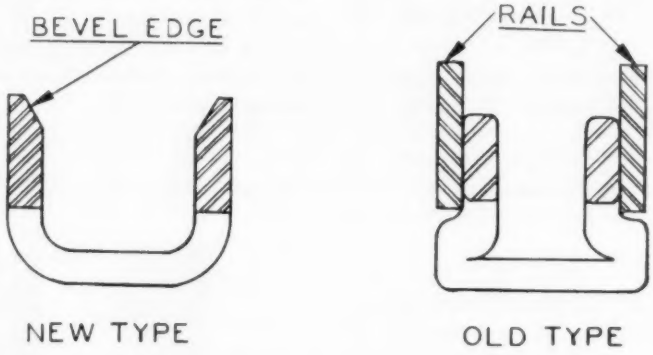
New and old springs are interchangeable but they must not be mixed in any one engine. You can identify each spring easily by the number of coils. The 100664 spring has 15 coils and the 8520-1 spring has only 9 coils.

Check valve opening pressures for all inlet connections in an engine should not vary more than 5 or 10-psi for smooth engine operation. They can be checked with a priming pump and pressure gauge, and balanced by use of spacers behind the spring.

I-H Flex-Type Oil Ring

A new one piece flex-type (Beveled Edge) oil control ring, has been released to improve engine oil economy on the U-372, U-406, U-450 and U-501 Power Unit engines. The new one piece oil ring replaces the three piece oil ring currently specified.

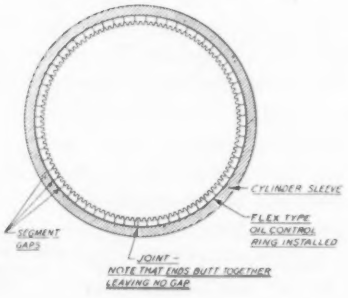
In addition to the new one piece beveled oil control ring on the U-501 engines, a material change was made to the 2nd compression ring, changing the material from low carbon iron to "M" iron. The new compression ring can be identified by the "V" notch in the butt end of ring.



For excessive oil consumption on above model engines built prior to this change, piston ring sets with the new one piece flex type (beveled edged) oil ring should be installed. The beveled oil control ring has no gap at the joint of the ring ends when installed on the piston and in the cylinder bore. The ring ends are tightly butted together. The many small gaps between the "U" segments serve the same purpose as the one large gap of conventional rings.

The construction of the ring is such that the normal free diameter is approximately 3/8 inch to 7/16 inch larger than the cylinder bore diameter, depending on the size of the ring. The numerous "U" segments are separated by gaps of from .007 to .010 inch as shown.

With the ring ends together and the ring compressed into the cylinder bore, the gaps between the "U" segments become decreased to approximately .005 to .003 inch. The installed ring will therefore have a combined gap equivalent of from .030 to .090 inches.

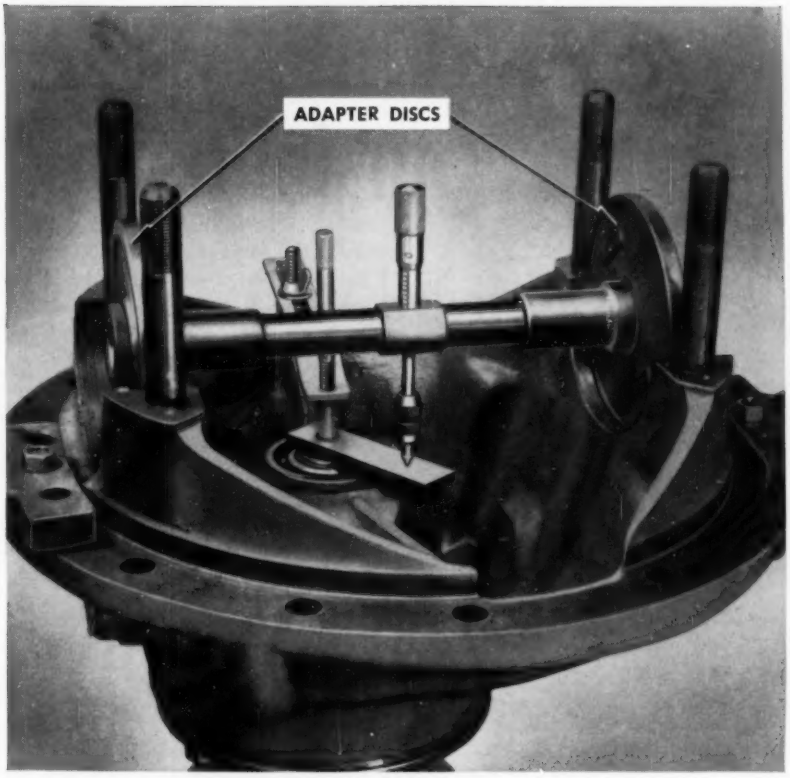


The beveled oil control ring maintains its pressure against the cylinder wall by having the ends of the ring tightly butted together, and through the spring action of the ring.

Oil control rings are available in standard and .020 oversize for U-372, U-406 and U-450 engines and are in standard, .020, .030 and .040 inch oversize for the U-501 engine.

Standard size oil control rings should be used in bores that are standard size to .020 inch oversize. .020 inch oversize oil control rings should be used in bores .021 to .040 inch oversize. .040 inch oversize oil control rings should be used in bores .041 to .060 inch oversize.

Note: Do not file or grind ends of beveled type oil control ring. Shims are *not* required to support the oil control ring when used on aluminum pistons having an oil slot. Locate piston ring ends over solid portion of piston not at the oil slot.



Save Time, Eliminate Guesswork And Increase Gear Life With This Pinion Setting Gauge

A motor truck repair shop is only as modern as the tools and equipment inside it. Even a first-class mechanic cannot function to the best of his ability with poor equipment.

This Kent-Moore precision-built Pinion Setting Gauge does away with old-fashioned trial and error or outright guesswork when determining the position of the pinion relative to the ring gear. It tells you exactly how much shim pack you need to quickly and accurately position the pinion to its mating gear.

The gauge basic unit is available separately with selected groups of adapter discs, or as part of a set which covers complete sets of adapter discs. The discs, used in conjunction with the Pinion Setting Gauge (basic unit), provide for a wide range of single-reduction axle differential bearings and for differential cross-bore bearings in two-speed and double-reduction axles.

Remember . . . trial and error methods burn up profits in increased working time and inaccurate results. Many hundreds of modern shops use this Kent-Moore Pinion Setting Gauge in motor truck service. They find it practically indispensable when installing new gear sets in hypoid and bevel drive heavy-duty axles.

Write for more information. We will be pleased to send you an illustrated brochure on how to install gear sets accurately.

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57–H1 ENGINEERS AND MANUFACTURERS OF SPECIAL SERVICE TOOLS AND EQUIPMENT

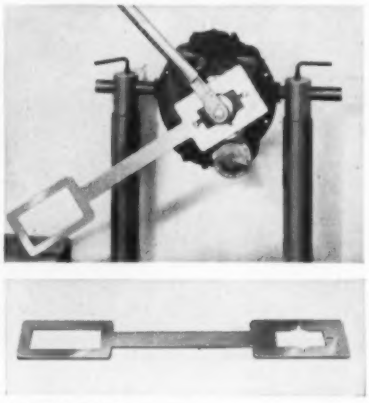
TIPS

ON HOW TO SAVE TIME AND PARTS DAMAGE WITH SPECIAL TOOLS BY KENT-MOORE

Take a tip from thousands of fleet repair shops. They've found out how Kent-Moore Rate-Maker tools and equipment help turn out jobs faster and easier without parts damage. Take these two for example:

J 3409 Differential Repair Stand

Save time, assure accuracy and increase safety—all three with this K-M Heavy Duty Repair Stand. In only two or three minutes you can mount large or small assemblies rock-solid and at the right working heights. All parts are at your finger tips. Eight different positions make quick, smooth work of any service operation.



J 3453 Pinion Flange and Yoke Holding Bar

When screwing and torquing a pinion shaft flange nut on or off any axle, you'll find this K-M Holding Bar anchors the pinion flange or yoke securely against the floor or against any convenient wooden block. Use it with the axle right on the vehicle or with the differential assembly mounted on the J 3409 Repair Stand shown above. You get more work done *faster* with Kent-Moore tools!

Write for catalog covering all Kent-Moore special service tools.

news of our industry

New I-H Research & Engineering Center

A new 450,000-sq ft. building is to be built for International Harvester's new Equipment Research & Engineering Center in Chicago. Chairman John L. McCaffrey, center, and President P. V. Moulder, right, are seen taking part in ground-breaking ceremonies with William M. Nanini, President of the Rock Road Construction Co.

Grading of the site involves moving some 150,000-cu-yd of dirt. Contract for this was awarded to Rock Road Construction Co. The contract to construct the building will be awarded next spring. Completion of the project is expected during mid-1959.

Detroit Diesel Powers Ditcher

Three Detroit Diesel-powered ditchers are being used near Twin Falls, Idaho on a natural gas pipeline project requiring one and a quarter million lineal feet of trenching. The project, carried on by Universal Pipeline Constructors, Inc., of Twin Falls, is to bring natural gas for the first time to 17 residential communities in southern Idaho. The Gar Wood Buckeye ditchers are digging at the rate of about two miles of trench per day.

new products . . . . . Page 64

organizational news. . . . . Page 68

new literature . . . . . Page 74

Cat Plans To Build New Plant

Plans to build a 500,000-sq ft industrial engine plant have been announced by H. S. Eberhard, President of Caterpillar Tractor Co. This new plant will be the source of manufacture for Caterpillar V-type engines ranging up to 650 maximum horsepower. Basic engines intended for industrial use will be moved to the Industrial Engine Plant where attachments, specially engineered to equip them for use as industrial and torque converter units marine engines or electric sets will be added.

Industrial Construction Expected To Continue in 1957

It looks like a good year for diesel powered heavy duty equipment. It's the concensus of members of the National Constructors Association which concluded its annual meeting in January, that builders of industrial plant facilities are looking for a continuation of the present high levels of construction throughout 1957. Presently existing backlogs plus contracts in process of negotiation assure a high level of industrial construction throughout 1957, steel, chemicals, petroleum and power are all areas of substantial activity.

Perfect Circle Co. goes to Australia

To fill the great need for local sources of precision engine parts such as piston rings, Perfect Circle Corp. will make them in Australia. This will be accomplished through an agreement with Automotive Components Ltd. of Sydney, Australia.

It is planned that diesel rings, liners, pistons and pins will be manufactured in Australia either by Perfect Circle Proprietary Ltd. or one of Automotive Components' other subsidiaries.

The new plant will be built in Melbourne and will be equipped with machinery by Perfect Circle in exchange for stock in the parent company. Production is expected to start by late 1957. James N. Kirby, leading Australian industrialist, will represent Perfect Circle on the board of directors.

HC units by Young installed at the Enterprise Engine & Machinery Co., San Francisco, Calif.

HC® UNITS by Young

COOL 10,000 H.P.

DYNAMOMETER

Largest dynamometer installation on the west coast . . . the Enterprise 10,000 H.P. machine depends on HC units by Young for meeting the necessary cooling requirements. The HC unit in the foreground above cools up to 1000 gpm. of test engine jacket water, while the other HC unit cools up to 800 gpm. of dynamometer water.

This is only one of many examples where Young's dependability of performance has been recognized by the diesel power industry. HC units by Young are used the world over for cooling water, oil and gases; and, for condensing steam and vapors. These horizontal core units combine the *efficiency* of vertical air discharge, the *economy* of compact Young design, the *versatility* of multiple unit installations. For *all* heat transfer problems, look to Young for *answers by specialists.*

Write Dept. 417-B
for FREE Catalog

Young RADIATOR COMPANY

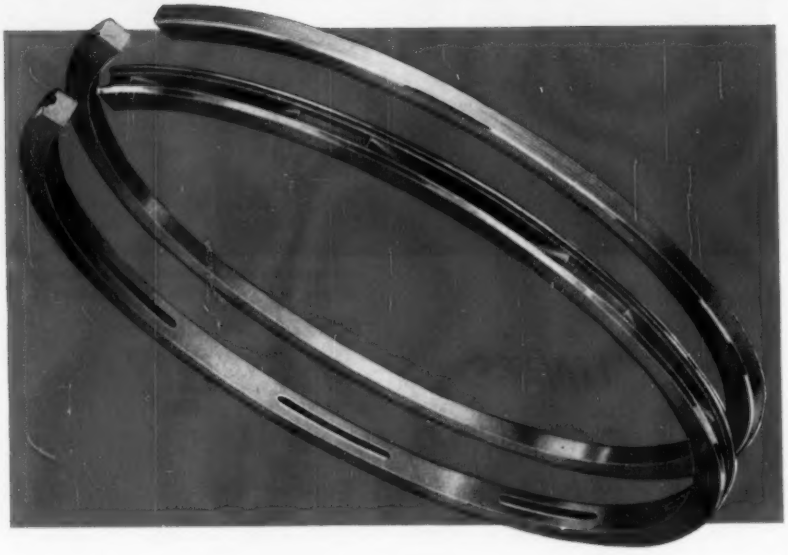
RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

DESIGNED SPECIFICALLY for DIESEL DUTY!



Leading diesel manufacturers use Perfect Circle piston rings for both original equipment and service requirements—for these very important reasons:

No other piston ring manufacturer can match PC's engineering facilities, experience and resources.

Many types of Perfect Circles, designed specifically for diesel applications, are available.

Experience proves that Perfect Circles uniformly deliver better performance and longer life under the most adverse conditions.

The Perfect Circle engineering staff will gladly assist you with your piston ring problems...no obligation of course. Perfect Circle Corporation, Hagerstown, Indiana; The Perfect Circle Co., Ltd., Don Mills, Ontario, Canada.

INSTALL

PERFECT CIRCLE

PISTON RINGS

THE STANDARD OF COMPARISON

news of our industry

New Address

The Diesel Engine Mfgrs' Association has changed its address to 2000 K Street, N. W., Washington 6, D. C.

New Diesel Driven Train Put Into Service

The "Daniel Webster", a new low-center-of-gravity, lightweight train has been put in service by the New York, New Haven & Hartford Railway.

Built by Pullman-Standard Car Mfg. Co., the train has a B-L-H diesel engine at each end, driving through a Maybach Mekydro hydraulic transmission, which consists of a torque converter and gear transmission box.

Mechanical engineers from B-L-H and the Railroad have been perfecting the operation of this new locomotive.

Detroit Diesel Training

A series of one week training sessions, covering the design, operation, and maintenance of Detroit Diesel two-cycle engines will be started at the GM Training Center in Atlanta. Similar sessions will be held during the year in GM Training Centers in Denver and San Leandro, Calif. Sessions will be manned by instructors from Detroit Diesel's Service Training School, and will be free.

Fourteen Mack Diesel Trucks Go To Belgian Congo

An order for fourteen Mack 275-hp diesel engine trucks of the LV off-highway design, has been received from the Union Miniere Du Haut Katanga, of Elisabethville, Belgian Congo.

These trucks will be used to transport copper ore from the Company's giant open pit copper mine at Kolwezi.

Capable of carrying 22½-ton loads, the trucks have Mack transmissions with torque converters and have bodies equipped with special heating, using the engine exhaust, to allow free flow of the ore when dumping. The company reports this order brings the total of Mack trucks for use in the Belgian Congo up to 37.

P & H Shovel is Built in Japan

Completion of the first Japanese produced P&H diesel-powered shovel at Kobe Steel Works, Kobe, Japan was announced by the Harnischfeger Corp.

This unit is a Model 255A crawler shovel with a ¾-yard capacity. Other 255A's as well as the model 955A, 2½-yd capacity crawler, are now under production in the Kobe plants.

On completion of the first unit, impressive rituals took place. These were performed by two Shinto Priests before a traditional Shinto Shrine. The ritual is intended to ward off evil spirits by presentation of food and wine to the Shrine.

P&H representatives foresee a ready market in the Far East for the Japanese-built machines.

Comparison Cost

At one pumping station that switched from steam-driven turbines to diesel-driven pumps, the total operating cost per million gallon was reduced from $22.41 to $12.72.

Correction

The Enfield Industrial Engines Ltd. has called our attention to the fact that the Enfield diesel engine-transmission combination described in our December issue is of English origin. This is not of French origin as was inadvertently stated.

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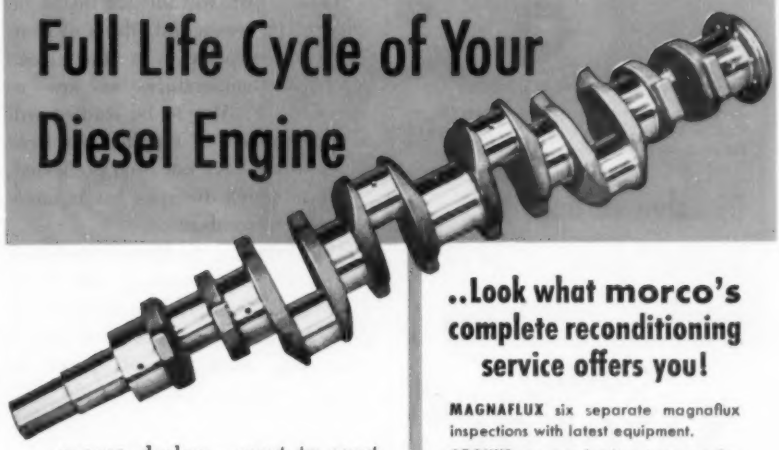
morco Factory-Certified Exchange Crankshafts give Trouble-Free Operation for the Full Life Cycle of Your Diesel Engine



morco dealers—coast to coast—are stocked with reconditioned, like-new crankshafts for different diesel engine models. Users of Detroit Diesel and Cummins engines can exchange worn shafts for MORCO factory-reconditioned shafts through authorized dealers.

Why take chances? Let your dealer be your source for dependable, safe crankshaft regrinding. You get immediate service, guaranteed quality and terrific economy. Ask your dealer about MORCO today.

..Look what morco's complete reconditioning service offers you!

MAGNAFLUX six separate magnaflux inspections with latest equipment.

GROUND on production type equipment to engine manufacturers' specifications. Original stroke retained.

TOCCO* HARDENED by the original equipment method when necessary.

ROLLED FILLETS increase strength at the most critical areas.

DYNAMIC BALANCE restored on original factory balancing equipment.

THRUST COLLARS and surfaces restored.

GEAR FITS renewed.

KEY WAYS restored.

DOWEL HOLES repaired.

OIL SEAL surfaces renewed.

THREADS repaired.

*TOCCO is a registered trademark of the Ohio Crankshaft Co.

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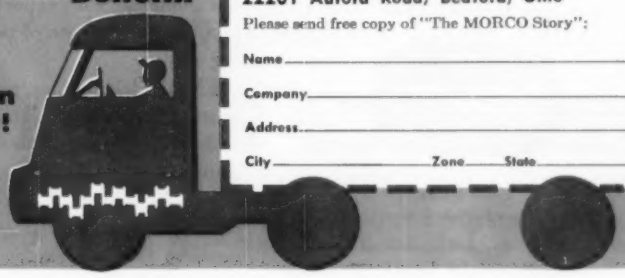

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Pistons after half-way immersion in Oakite Saturol. Notice how this powerful solvent cleaner reaches into grooves.

Dissolve carbon, grease, gum . . . in minutes . . . with new Oakite SATUROL

This brand new solvent cleaner is just about perfect for cleaning pistons, valves, filters, gears and other small diesel parts. A brief immersion in Oakite Saturol melts off everything—carbon, grease, paint, gasket compound . . . leaving the metal clean and bare.

Parts to be cleaned are immersed in the solvent for ten minutes to half an hour depending on condition, then rinsed off with kerosene or water . . . and that's all there is to it. Oakite Saturol has a floating vapor seal that assures long life and economy. High flash point and safety on all metals are extra advantages.

Besides large and small drums, Oakite Saturol comes in a special 6-gallon trial pail, complete with immersion basket. Ask your local Oakite Technical Service Representative to demonstrate, or write for more details to Oakite Products, Inc., 22C Rector Street, New York 6, N. Y.

OAKITE

Export Division
Cable Address: Oakite

Technical Service Representatives in Principal Cities of U. S. and Canada

news of our industry

Engine Low Temperatures to be Studied

The Pennsylvania State University has been awarded two research grants totalling $83,371.60 for the purpose of studying engine low temperature problems.

This project will include investigations of processes and effects of heating engines prior to a starting attempt at temperatures as low as minus 65°F. Also to be studied will be the problem of starting diesel engines which have not been preheated, but into which diethyl ether is introduced for combustion.

Dr. Wolfgang E. Meyer, professor of engineering research, will be in charge of the studies while Julius J. DeCarolis, associate professor of engineering research, will serve as project engineer.

EMD Increases Production

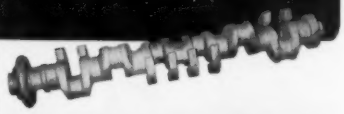
A 42% addition to manufacturing space at the EMD main plant at La Grange, Illinois has become necessary. According to N.C. Dezendorf, V-P of General Motors and general manager of Electro-Motive Div., the reason for this is the acceptance of EMD products in two new fields. These are mobile diesel-electric power units and diesel electric units for deep oil well drilling equipment, plus continued strength of the diesel locomotive market.

Domestic locomotive deliveries during 1956 were 50% greater than 1955 and export locomotive business increased approximately 60% over 1955. Dr. Dezendorf states the eventual world market for diesel locomotive sales potential is greater than the domestic locomotive market. Locomotives for export are being produced at the rate of two per working day.

EMD's locomotive remanufacture continued to expand during the year, with the volume of locomotive and component remanufacture increasing about 70% over 1955. Locomotive parts business showed over an 18% increase for the year.

Park
DIE-FORGED

CRANKSHAFTS



CRANKCASE PARTS

CONNECTING RODS

Are the Strongest "Links" in your Power Transmission Chain

For over 49 years, Park has specialized in the closed-die forging of crankshafts, connecting rods, camshafts, crankcase parts, main bearings, gears, pinions, axles and steering knuckles.

Park's facilities include a complete die sinking shop, modern specialized heat treating equipment and experienced metallurgical and engineering staffs.

Die Forging Specialists Since 1907

THE PARK DROP FORGE CO.
CLEVELAND 3, OHIO

CARBON, ALLOY AND STAINLESS STEEL CLOSED-DIE FORGINGS FROM 4 LB. TO 5000 LBS.

news of our industry

GM's "6-110" Engine Now Turbocharged

Following on the heels of the addition of two turbocharged models to the Series 71 line of engines, Detroit Diesel Engine Division, GM, has now announced that a turbocharged "6-110" model is now available.

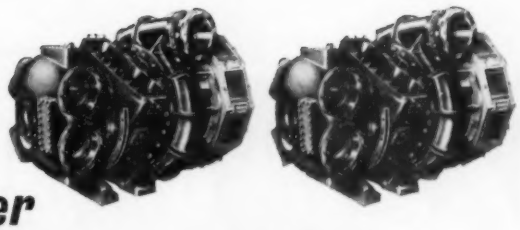
Some time back, the "6-110" went through a redesign in which a Roots-type blower replaced the earlier centrifugal model. This was one of many changes. Now, a turbocharger has been placed in series with the blower after the fashion of the turbocharged Series 71 Turbopower engines.

The result is a boost from 300 to 375 horsepower. With the additional air, combustion is improved, efficiency increased and better high-altitude performance is obtained with no increase in fuel consumption.

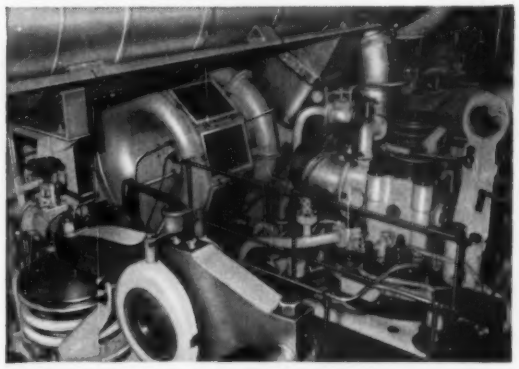
In announcing this development, Robert E. Hunter, general sales manager, commented on the economic trends that make higher horsepowers so desirable. In roadbuilding, for example, higher-power, higher-capacity machine can be used. Let only one operator is needed despite greatly increased production. The result is lower unit costs.

Twin Diesel Tractor Packs 416 HP

Just introduced by LeTourneau-Westinghouse is a 40-ton synchronized twin-diesel tractor. According to John W. Schoen, V-P of the company, the Twin-C combines for the first time, power and high speed—desirable to get top production from big scrapers. LeT-Westinghouse dynamometer tests cite that on a footing of sandy clay, the Twin-C in first range has recorded a drawbar pull of 65,900 lbs. With speeds of 20 mph forward and 5.8 mph in reverse, the tractor matches the pace of self propelled scrapers and can move fast in either direction. The dual engine power is completely synchronized with air and electric controls, making the Twin-C easy to operate.



These Napier Turbo-blowers were chosen



for this engine

Two Napier Type MS 600 turbo-blowers are fitted to the Burmeister & Wain 6-cylinder single-acting two-stroke diesel engine which powers the Compagnie Maritime Belge (Lloyd Royal) M.V. LUSAMBO. This Burmeister & Wain engine was made under licence by S. A. Cockerill and Ougrée in Belgium. The ship is one of three which have Burmeister engines with *Napier* turbo-blowers. Why were *Napier* turbo-blowers chosen? Here are three good reasons:

- Napier blowers have *high adiabatic efficiency*, resulting in maximum power increase and low fuel consumption.
- Journal bearings on the MS 500 and 600 Napier blowers are sleeve type, and with proper lubrication they will last as long as the engine itself. The MS 500 and 600, the largest blowers in the Napier range, are built especially for marine applications.
- A high standard of workmanship is guaranteed by Napier's long experience in precision engineering.

Napier turbo-blowers are available in seven sizes for engines of 140-4,000 h.p. afloat and ashore. Multiple installations for engines of higher powers. On 4-stroke diesels they can double the power, on 2-strokes they increase it by over 30%—often at a lower specific consumption. Napier turbo-blowers are currently in use in 69 countries.

which powers this ship

NAPIER Turbo-blowers

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CRC TI4

new products

Electrified "Screwdriver" Probe Simplifies Checking Part Wear

Sperry Products Inc. has electrified the old fashioned screwdriver and cupped hand technique. They have connected a probe with a compact electronic amplifier and produced the Sperry Bearing Tester. This device will detect and measure wear in bearings, gears, spindles, etc., without taking machinery apart. It assures precision fitting of mating parts.

The device enables maintenance engineers to keep machinery operating at established standards. Machinery can be tested under actual operation conditions.

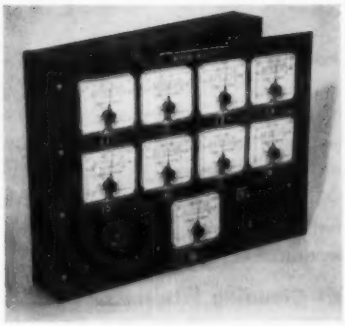
The instrument, consists of a metal probe connected by electric cord to an electronic amplifier equipped with calibrated meter, loudspeaker controls and devices for making permanent records. Any electric outlet can be used. Noise energy and changes therein, are shown visually on a meter, calibrated from 0 to 100 and sensitivity range on the meter is adjustable for various energy levels.

Internal Microhardness Testing Problem Solved

Alco Products, Inc., can now determine microhardness of interior surfaces of chrome-plated metal castings, such as diesel cylinder liner bores. This is accomplished by using a Tukon Type MO Tester, made by Wilson Mechanical Instrument Div. of American Chain & Cable Co. Hardness of outside surfaces was readily determined, but the problem of correctly determining microhardness of interior surfaces remained.

This tester is mechanically operated and load is applied under dash-pot control, the speed of which can be varied from less than 0.04 in. per minute to as fast as testing permits without influencing results. Rate of application and duration of load are under constant supervision of the operator.

Loads from 1 to 1000 grams can be applied to any and all specimens under observation. The focusing of the impression under the microscope is accomplished through the unit's elevating mechanism.

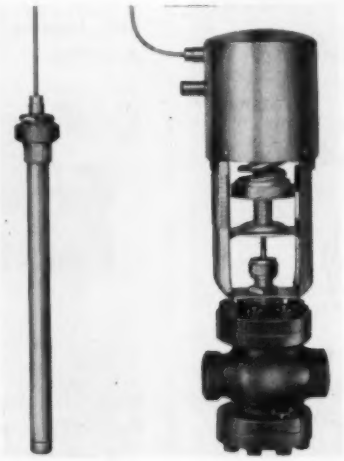


Bearing Monitor

A multi-point bearing monitor, providing centralized and automatic temperature protection for bearings is announced by Tipp-Tronic, inc. The controller is especially suited for use with such installations as diesel engines, stand-by generators, pumping systems, or wherever replacing burned-out bearings usually costs more than the equipment.

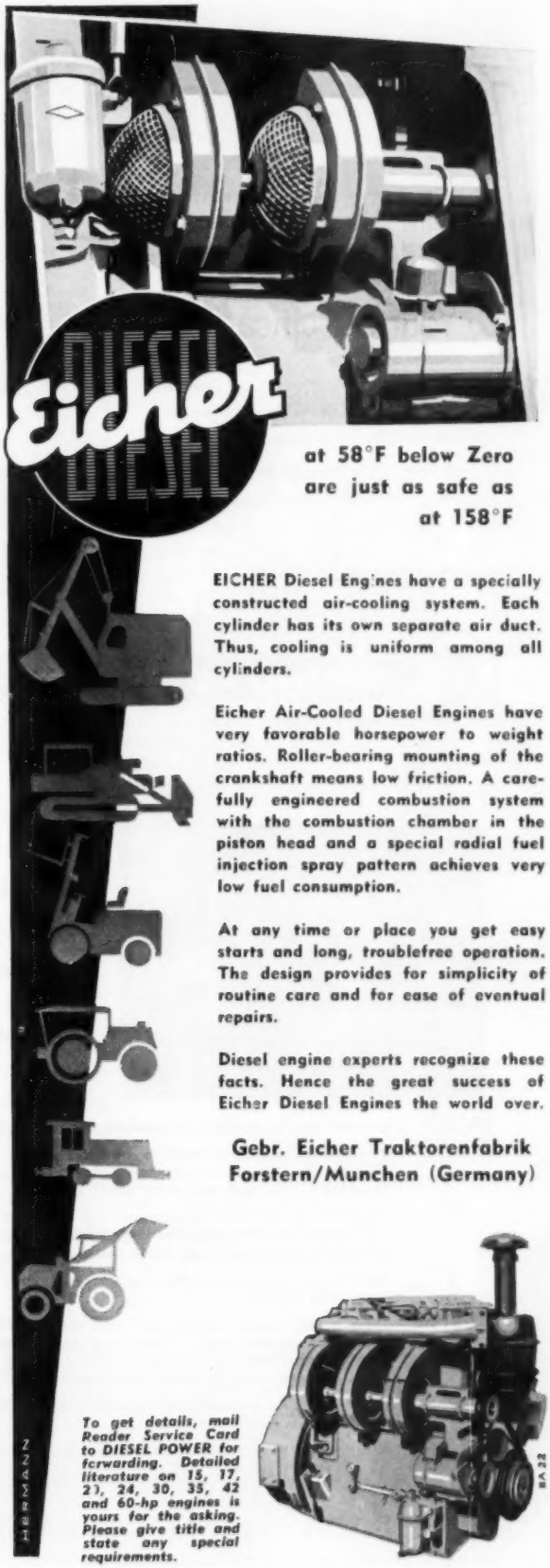
Stainless Steel Temperature Regulator

Designed to withstand the corrosive effects of certain fumes, gases, acids and chemicals, a stainless steel temperature regulator is now offered by Fulton Sylphon Div. of Robertshaw-Fulton Controls. According to the manufacturer, the 11061-R regulator was developed for chemical plants, plating rooms, or for use in exposed locations. Temperature range is between 20°F and 455°F.



Wrench and Vise Chain

Morse Chain Company has added the WC-522 wrench chain to its line of standard industrial products. Primarily for chain wrenches and vises, the new chain may be used wherever strength-in-tension, flexibility, and quick, easy changes in chain wrap are necessary. Extended pins on both sides, each pitch, provide positive locking action. Natural flexibility holds any material firmly without scratching.



at 58°F below Zero are just as safe as at 158°F

EICHER Diesel Engines have a specially constructed air-cooling system. Each cylinder has its own separate air duct. Thus, cooling is uniform among all cylinders.

Eicher Air-Cooled Diesel Engines have very favorable horsepower to weight ratios. Roller-bearing mounting of the crankshaft means low friction. A carefully engineered combustion system with the combustion chamber in the piston head and a special radial fuel injection spray pattern achieves very low fuel consumption.

At any time or place you get easy starts and long, troublefree operation. The design provides for simplicity of routine care and for ease of eventual repairs.

Diesel engine experts recognize these facts. Hence the great success of Eicher Diesel Engines the world over.

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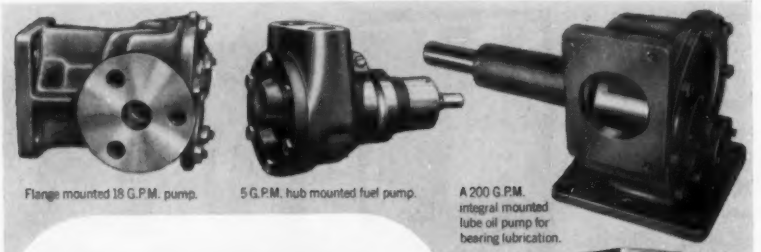
To get details, mail Reader Service Card to DIESEL POWER for forwarding. Detailed literature on 15, 17, 21, 24, 30, 35, 42 and 60-hp engines is yours for the asking. Please give title and state any special requirements.



Flange mounted 18 G.P.M. pump. 5 G.P.M. hub mounted fuel pump. A 200 G.P.M. integral mounted lube oil pump for bearing lubrication.

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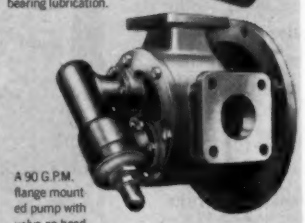
Viking lube oil, fuel oil and coolant pumps, built to fit your equipment, are a specialty of Viking.

Shown here are only a few of many special pumps, ranging in size from 5, 10, 18, 90 to 200 gallon per minute. Smaller and larger pumps also available. Send today for folder 57Sd.



A 90 G.P.M. flange mounted pump with valve on head.

A 10 G.P.M. opposite port oil pump built to specifications.

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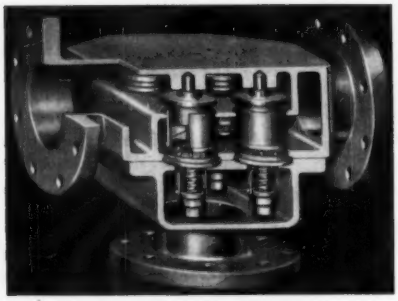
See our catalog in Sweets



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JACKET WATER & LUBE OIL THERMOSTATS

SAFETY	Provided for by multiple independent elements as shown above.
√	Provided for by rugged AMOT element construction. No AMOT element has ever stuck closed since its introduction 6 years ago. Many years of "know how" are built into every AMOT element.
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SERVICE	There is only one replaceable part—the element. Renewal of element renews all working parts. Element replacement, if ever required, is several times faster than on any competitive make. Original accuracy of temperature setting is always provided in element replacement.
√	AMOT engineers are available in most major cities to help on application and other problems.
√	Most models are available from stock for rush orders.
MODELS	½" to 6" pipe sizes. Larger sizes in iron, bronze or ductile iron.

AMOT CONTROLS CORPORATION • FIRST ST. & NEVIN AVE. RICHMOND, CALIFORNIA

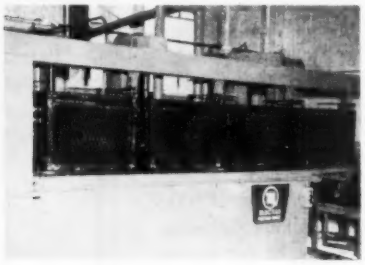
new products

"Ferulset" Tool

Parker has designed a tool to aid in making up flareless-tube fittings. The vise-mounted tool expedites presetting because wrench action can be applied more advantageously, and easy access encourages visible inspection.

Self-Cleaning Filter

A 40-micron self-cleaning filter element, with a choice of cleaning method, is available from Cuno Engineering. Suitable for use with a wide variety of liquids, such as diesel lube and fuel oil, cleaning can be either motor-driven continuous, or manual intermittent. Styles are for either in-line housing or integral (sump) mounting.



New Cleaning Machine for Panel-Type Air Filters

Magnus Chemical's Equipment Division has added to its line of cleaning machines for the diesel industry. The "Magnus Automatic Filter Dip" is fully automatic, thoroughly washing, rinsing, oiling and drying diesel locomotive air filters.

Only manual operation is the loading of dirty filters in the basket and unloading the cleaned and oiled filters at the end of the cleaning cycle.

The filters are automatically moved from the loading platform to a cleaning tank, are then oscillated up and down 80 to 100 times a minute, transferred to the rinse tank by conveyor belt, then to the oil bath where they are completely immersed, to insure proper coating. Again automation takes the filters to a steam-heated dryer, then feeds them to a conveyorized platform for transfer to the original spot for unloading.

new products

Expanded Line

The range of nuts employing the Nylok self-locking principle has been enlarged by the Nylok Corp. to include sizes down to #0. They are available in a wide range of ferrous and nonferrous materials.

Simple Gear Pump

A gear pump featuring simplicity of design and manufacture has been developed by New Products Corp. Adaptable for a multiplicity of applications, its mating gears can be mass-produced without the penalty of close tolerances or fine gear finish. Molded synthetic rubber acts to seal off any irregularities. A maximum of 150-psi can be developed.

Vibrometer Modification

The Vibroscope Co., manufacturers of vibration measuring instruments have modified their Davey Model P vibrometer.

Instead of being mounted horizontally, the scale now slopes at an angle of 30°, with the glass scale visibility for vertical and horizontal readings. The Vibrometer measure vibration amplitude on machine structures and will also measure directly on the surface of rotating shafts, by means of an integral probe.

Available in magnifications of 125:1, 250:1 and 500:1, this device has a light beam reflected on graduated ground glass scale where the amplitude indication appears as a band of light.

Oil Drilling Engine

First exhibited at the Permian Basin Oil Show at Odessa, Texas, a Superior 8G-825 gas engine features a 6597-in. displacement. Built with the simplicity of former Superior engines, this conservatively rated version is designed for long trouble-free drilling duty. The design permits maintenance or overhaul problems to be answered at the rig for a minimum of downtime.

New Dual-Purpose Tool Socket

The Wright Tool & Forge Co. has introduced dual-purpose tool socket called "Ten Point". This socket will fit square and hex nuts interchangeably, thereby doing away with buying two separate wrenches. Forged from chrome alloy steel, the socket sacrifices no strength with the dual capacity. It meets and exceeds government specifications for strength in hex, square or octagon sockets.

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You can count on efficient, expert service for your Quincy Compressors from any of the more than one hundred Quincy Authorized Service Depots across the country. Adequate stocks of genuine factory parts are maintained for every model in the Quincy line. And because Quincy service people realize the importance of air power on your job, you can be sure of service-plus when you need it, where you want it. Depend on Quincy Compressors and Quincy service for all your needs from 1 to 90 CFM. Write Dept. J-53 for catalog today.
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COMPRESSORS
FOR LOW COST AIR POWER
QUINCY COMPRESSOR CO., QUINCY, ILLINOIS

organizational news

Briggs Filtration Co.

announces the appointment of Mr. R. C. (Swede) Swenson as representative in the middle west. He will handle automotive filter sales, which includes the truck, bus and construction equipment fields, with headquarters in Chicago, Illinois. Mr. Swenson has been with Briggs for the past eight years.

R. C. Swenson

R. M. Thomas

R. P. Austin

Perfect Circle Corporation

announces the appointment of Robert M. Thomas to a newly created post of Staff Sales Consultant. Formerly Sales Manager, Manufacturers Division, his vacated position will be filled by Rufus P. Austin, who for the last eight years has been in charge of PC's Detroit and Chicago offices.

Robert Bosch Corp.

the American subsidiary of Robert Bosch GmbH in Stuttgart, Germany has elected Foster N. Perry as Chairman of the Board of Directors. Mr. Perry who will continue at the same time as Special Representative of the parent company ,was previously associated with the American Bosch Corp. in Springfield, Mass. for 32 years, the last five as executive V-P.

F. N. Perry

REBORE CONNECTING RODS IN YOUR OWN SHOP

New GREENLEE

HYDRO-BORER

Assures precise alignment.
Accurate to .0003" T.I.R.
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Quick, easy setups.
For any size rods.
A money-maker in every engine shop.

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One S.P.D.T. switch to trip at speeds between 500 and 6,000 RPM.

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Two S.P.D.T. switches to trip at two different speeds between 500 and 6,000 RPM.

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Three S.P.D.T. switches to trip at three different speeds between 1,200 and 6,000 RPM.

Speeds above or below those listed above must be referred to our Engineering Department for special consideration. Request Bulletin 504 describing our Speed Sensitive Switches.

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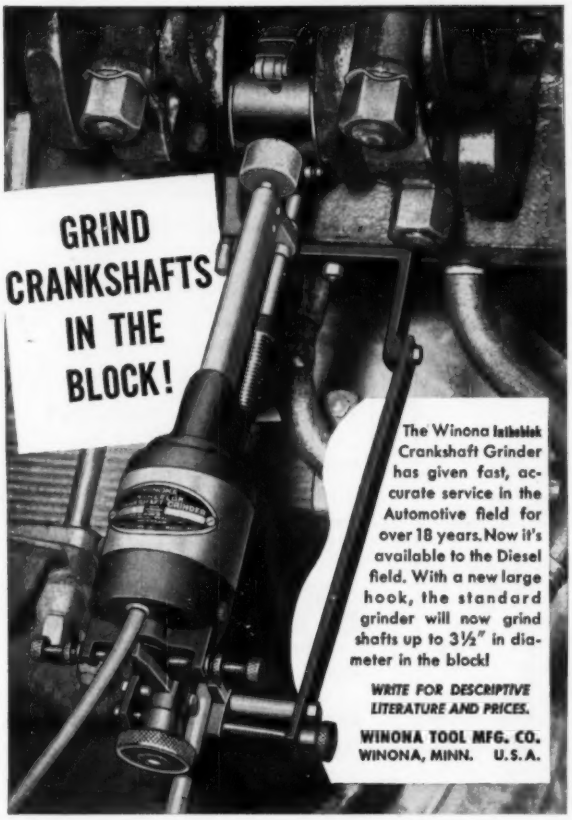
INCORPORATED
8151 N. RIDGEWAY AVENUE, SKOKIE, ILLINOIS
Automatic Engine Control Sets—Safety Alarm Sets—Special Control Panels—D. C. Solenoids—Heavy Duty Relays


GRIND CRANKSHAFTS IN THE BLOCK!
The Winona Istheblok Crankshaft Grinder has given fast, accurate service in the Automotive field for over 18 years. Now it's available to the Diesel field. With a new large hook, the standard grinder will now grind shafts up to 3½" in diameter in the block!
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DIESEL

indicator valves

OPERATES AT PRESSURES UP TO 10,000 PSI

Kiene valves have effective gas seal both open and closed without packing or glands. Operate against pressure — will never blow open. Small and rugged — 4¼" in length with only 3¼" circle of space for attachment. Kiene valves give better service under the most severe conditions. Standard indicator plug and wing nut connection.

Furnished with male ½" NPT engine connection. Other threads on order. Adaptations for most diesel locomotive engines.

SEND FOR BULLETIN V-10

KIENE DIESEL ACCESSORIES, INC.
10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

organizational news

C. G. Cooper

Cooper-Bessemer Appoints

Charles G. Cooper to the export division in the capacity of Vice President and Director of the parent company and as V-P of C-B subsidiaries. Formerly in charge of government and Southeastern district sales, Mr. Cooper assumed his position in the New York offices on January 1, 1957. Cooper is currently a council member of the Society of Naval Architect and Marine Engineers as well as an active member of ASME.

Mack Asst. to Pres.

George E. Engelmann has been appointed Executive Assistant to P. O. Peterson, president of Mack Truck.

Joining Forces

Two manufacturers of flexible tubing are joining forces. The Flexonics Corp. has acquired the Flex-O-Tube Division of Meridan Corp.

Weatherhead Expands Field Staff

The Fort Wayne Division of the Weatherhead Company has appointed D. M. van Waldick as a Field Engineer and Sales Representative in No. Illinois, Michigan City, Ind., and Davenport, Iowa.

I-H Appoints

Ralph G. Greer has been appointed Asst. Sales Manager of the Construction Equipment Division of International Harvester, succeeding C. E. Jones, who has been named Supervisor of National Contractors' Sales.

Deutz Distributor

Slattery, inc., of Akron, has been appointed a distributor for Deutz air-cooled automotive diesel engines.

A. F. Campbell

Detroit Diesel Retirement

Arch F. Campbell, Manager of Engine Sales to the petroleum industry for Detroit Diesel Engine Div (GM) retired January 1 after 37 years association with the petroleum industry.

Minneapolis-Moline's

new acquisition to the company is that of Wesley E. Schwieder who will be the new chief engineer of research and development of tractors and engines. Mr. Schwieder was formerly with Studebaker-Packard.

BARSAD
Pat. Pending

FOR DIESEL ENGINE, BOILER AND GAS TURBINE FUELS
High temperature corrosion caused by sulfur, vanadium and sodium is a major problem to operators of diesel engines, gas turbines and high pressure boilers. BARSAD will prevent this corrosion.
For details write R. S. NORRIS & ASSOCIATES
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For Diesel Engines From the Smallest to the Largest
TRE-COR Prevents Conditions that Cause Overheating
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Fuel pump parts	Gaskets
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Parts and Service
Models—B-BP-PBM, A-PA-PAM, C-PCM-PC, V-VM, V-8
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DO YOU WANT TO CUT FIELD OPERATION COSTS WITHOUT ADDED EXPENSES OR PURCHASES ON YOUR PART? IF SO, SEND FOR THIS REPORT.

"OUR SLUDGE PROBLEM IS COMPLETELY LICKED. Removed covers from one of our 3-71 GM's for the first time in eight years. It was clean and no sludge whatever," says Indian River Farms Drainage District
THEY HAVE HAD A SOLID 15 YEARS of less down-time . . . 15 years of trouble-free field performance . . . Write for your copy of this report. You can put the facts to work at once.

PART OF INDIAN RIVER FARMS EQUIPMENT.

Briggs PIONEERS IN MODERN OIL FILTRATION
OIL FILTERS
THE BRIGGS FILTRATION COMPANY, DEPT. 153, WASHINGTON 16, D. C.

CORRELATION OF LABORATORY INSPECTION OF LUBE OIL WITH FIELD TESTS
Briggs

LET'S SEE IT at no cost to me send me report shown.
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organizational news

Sharples Corp. Announces A New Assistant
to the executive Vice President. Mr. Larry Wyman, formerly with various Henry J. Kaiser organizations has now assumed his new post.

Bridgeport Thermostat Division of Robertshaw-Fulton Controls Co.
have officially opened their new plant. Worth $2-million, the 180,000 square foot building, represents one of the largest manufacturing plants in the Milford, Connecticut area.

A-C Purchasing Posts
E. H. Bartelt has been appointed Assistant Purchasing Agent at Allis-Chalmers Terre Haute works. His former spot, Assistant Purchasing Agent, Electrical Equipment, has been filled by F. E. MacDonald.

Garlock Packing Co.
has created a new Product Engineering Department to be under the direction of E. W. Fisher. Processing of technical inquiries, testing of products and product development are among the items the new department will be responsible for. A member of the American Society of Lubricating Engineers, Mr. Fisher has been with the company since 1933.

organizational news

E. J. Raushenberger

In Memorium

Everett J. Raushenberger, head of the Internal Combustion Plant Section, REA, died January 3 following a heart attack. A member of ASME and AIEE, Mr. Raushenberger was widely known for his work in diesel power plant engineering and for his technical papers and engineering articles. He did much to promote the use of diesel engines in electrical generation service and to improve the effectiveness of their use. His passing is a loss to the industry as well as to his many friends in it. Funeral services were held in Danville, Illinois.

Air-Maze RR Rep.

William A. Powers has been appointed Railroad Representative of Air-Maze. He is based in Chicago.

Whitehead Cornerstone

The cornerstone for a 35,000-sq ft office and warehouse for Whitehead Metal Products Co. was laid in Windsor, Conn. by Gov. Ribicoff.

Alcoa Power Engineering

Establishment of a Power Engineering Division within the Engineering Dept. of Aluminum Company of America was announced by J. P. Haight, recently appointed V-P in charge of Engineering and Purchasing. Alcoa's growth and increasing interest in the use of several energy sources for power generation were cited as principal reasons for creation of the organization.

Stewart-Warner Corp.

through a special department headed by Ralph Buscarello, will now handle their complete line of electronic industrial equipment formerly marketed by Merrill Engineering Labs. An initial step in marketing this line of equipment, was the appointment of 15 exclusive distributors.

Westinghouse Traffic Mgr.

Charles D. Duffy has been named General Traffic Manager of Westinghouse Electric Corporation.

D. J. LaBelle

GMC Truck Engineer

D. J. LaBelle has been appointed Truck Engineer of GMC Truck and Coach Div.

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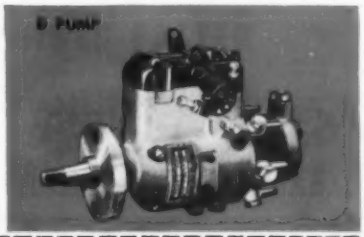
HMS ROOSA MASTER Authorized SALES AND SERVICE

You will see this sign identifying ROOSA MASTER sales and service agencies that have been established all over this country and around the world. Our expanding organization will provide service, when needed, for the complete satisfaction of our growing family of satisfied customers.

After years of research and development and intensive laboratory and field testing, the revolutionary ROOSA MASTER Fuel Injection Pump has now proven itself for dependability, long life, low cost operation, and freedom from servicing. In its rapid expansion ROOSA MASTER has spread to all corners of the world making good diesels better wherever it is in use.

Send for a copy of HMS ROOSA MASTER Directory of Authorized Sales and Service Agencies. It is up to date and will list the agency nearest to you for your satisfaction when you **make your good diesel better.**



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HARTFORD MACHINE SCREW COMPANY
DIVISION OF STANDARD SCREW COMPANY
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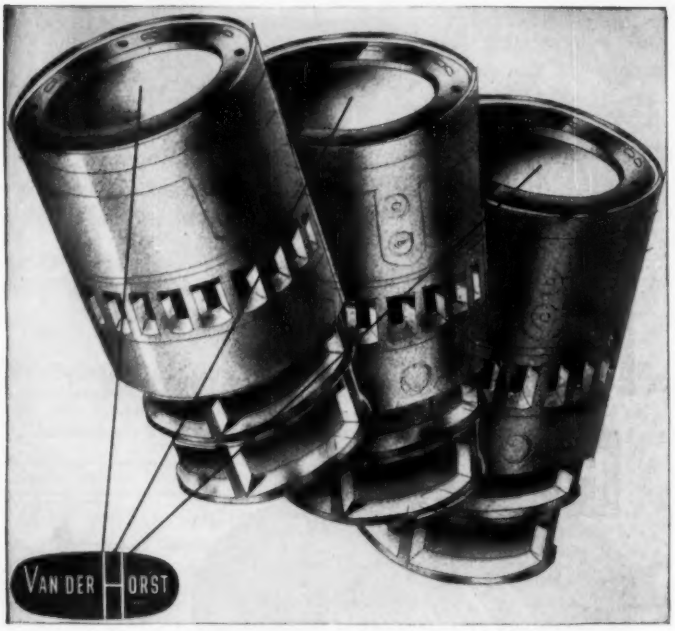

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Good for the Life of your Engines

PORUS - KROME	INCREASES PISTON RING LIFE UP TO 50%.
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TERRELL, TEXAS — LOS ANGELES, CALIFORNIA

organizational news

Sharples VP

Eugene C. Swift has been named Vice-President in Charge of Finance of the Sharples Corp.

Ohio Crankshaft Appoints

A. H. Schott has been appointed General Manager of the Crankshaft and Camshaft Div. of the Ohio Crankshaft Co.

L. T. Gerlack

Kenworth Motor Truck Co.

announces the appointment of Lewis T Gerlack as general sales Manager.

Mr. Gerlack succeeds R. D. O'Brien on the latter's advancement to V-P and general manager of the trucking firm.

R. E. Bond

AMF Appoints

Ralph E. Bond, former controller, has been appointed Deputy General Manager for Administration of the Electronics Division of American Machine and Foundry.

New President

The American Institute of Mining, Metallurgical, and Petroleum Engineers announced the election of Dr. Augustus B. Kinzel as President for one year. Dr. Kinzel is V-P of Union Carbine and Carbon, in charge of Research.

organizational news

Joins Oil Industry

Odell Campbell, formerly of DuPont in Tulsa, has joined Kerr-McGee Oil Industries, inc. He is Technical Assistant to R. M. Chesney, Vice-President in charge of refining.

George Engine Co.

have made known two important appointments within the framework of the company. Ed. Henderson has been named Assistant Service Manager for Electro-Motive Drilling Rig Equipment and Willis Miller has taken over the job of Assistant Sales Manager in charge of Electro-Motive Drilling Rig Equipment.

R. K. Lorton

Centrifugal Foundry Co.

president, R. H. Bancroft, tells of the appointment of Ralph K. Lorton as plant manager, replacing C. W. Anderson who resigned as of January 1, 1957. Starting with the company in 1932, Lorton has held several supervisory positions and since 1949 has been production superintendent of the casting plant in Richmond, Ind.

Detroit Aluminum and Brass Corp.

has appointed Jerome J. Frank as President of the Company, as part of rapid promotion of young executives to cope with the company's large expansion program. Mr. Frank, 44 has been executive vice president of the company since 1952. He succeeds Mr. Lloyd G. Hooker who was promoted to the post of vice chairman of the board.

F-M Mfg. Changes

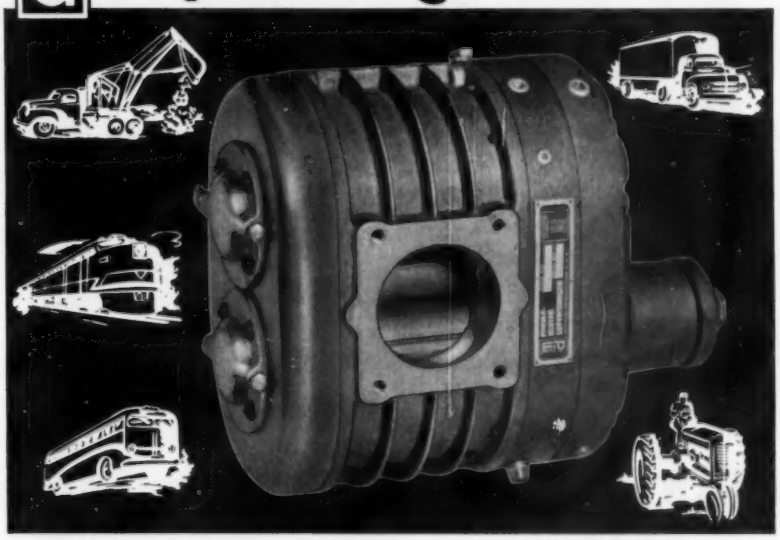
Fairbanks, Morse & Co. has announced a number of changes in their manufacturing organization personnel, including P. R. Flood promoted to General Manager of the Beloit works; W. P. McAnally transferred to manage the Pomona works; and C. H. Johnson promoted to General Manager of the Stuttgart (Ark.) works.

B-W Elects

The election of Henry M. Haase as Vice-president in Charge of Engineering and Research for Borg-Warner Corp. was announced by Roy C. Ingersoll, Chairman of the Board. Mr. Haase came to B-W in 1955 as Assistant to the Pres. In his new capacity, Mr. Haase will be in Product Planning and Engineering Research and Development.

DIESEL ENGINES NEED

Supercharged Power



MIEHLE-DEXTER SUPER-CHARGERS

INCREASE HORSEPOWER, TORQUE, ACCELERATE YOUR ENGINES FASTER

Wherever Diesel engines work—buses, tractors, trucks—a Miehle-Dexter Supercharger adds a big boost to performance. Power is increased by the simple addition of this compact, space-saving supercharger. That means *extra* speed at any load, *extra* pushing or pulling power at any speed, wider speed range. More, it means faster acceleration with less smoke. Add all this to engines without increasing size, weight or cost. In fact, weight per horsepower is decreased. Standard M-D models available for most engine applications. For more facts, call or write Miehle-Dexter.

Soon available AN ENTIRELY NEW TYPE OF TURBOCHARGER

MIEHLE DEXTER

Supercharger Division of

The Christensen Machine Co.

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new literature

Pressure Gages

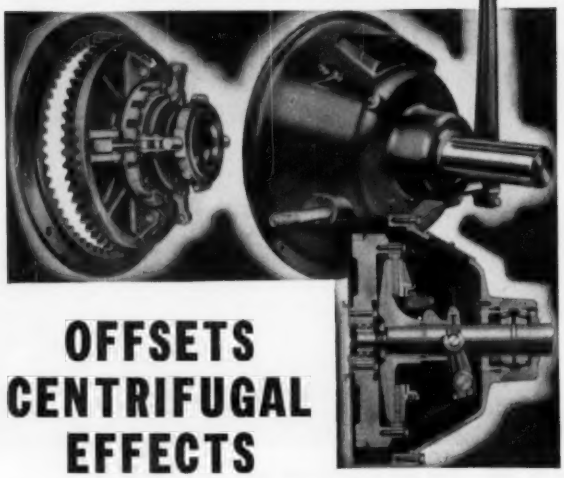
Helicoid Gage Div. of American Chain and Cable has prepared bulletin DH-23, a 4-page folder featuring gages for use on engines, turbines blowers, locomotives, hydraulic presses, tractors, pumps, compressors, or wherever a gage is subject to violent pressure pulsations.

ATA Training Guides

Three training guides covering pick-up and delivery, dock, and line haul operations have been completed and are available for purchase, the Operations Council of ATA announced. Guides are available in loose leaf form, and are adaptable to any trucking company's operation.

ROCKFORD

BALANCED CLUTCH LINKAGE



OFFSETS CENTRIFUGAL EFFECTS

Disengagement of the clutch in ROCKFORD Power Take-Offs is positive. It is accomplished by a linkage arrangement which is counterbalanced to offset the effects of centrifugal force—*prevalant in high-speed modern engines.* This is just one of several competitive advantages ROCKFORD Power Take-Off equipped engines provide.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

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Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

Motor Selector

A 12-page motor selector, published by Reliance Electric and Engineering, gives full information on how to select a-c motors for specific applications. Included in bulletin B-2103-1 are two pages of motor terminology.

Emergency Transformer Capacity

Ways to utilize hidden transformer capacity during a long shutdown of a large power transformer are described in an 8-page leaflet released by Allis-Chalmers. Various methods of cooling the unit are described.

Nickel Cadmium Battery Information

to help engineers evaluate practical use of miniature nickel cadmium batteries for diesel engine starting, is offered in an eight-page technical report released by Nickel Cadmium Battery Corp. Details of development, construction and operation are shown along with curves of discharge and charge characteristics.

New A-C Construction Machinery

is illustrated in three new pieces of literature released by A-C's construction machinery division. Catalog views and usage information of the HD-11G and the HD-6G diesel-powered crawler tractor shovels and the pull-type scrapers are featured respectively.

Arc Welder and Accessory Catalog

is now available from Airco Co. Selenium rectifier, DC motor generator arc welders for industrial welding, AC and DC engine-driven arc welders for construction and maintenance use are examples of the company's line illustrated and described in this catalog.

Aid for Technical Writers

is found in a Minneapolis-Honeywell published compact handbook, entitled "Why Not Just Tell Them". This manual is designed to help writers of technical material to steer clear of "engineeringese" and roundabout explanations. If you write reports, technical papers, instruction manuals or any other sorts of technical material you'll find this concise, excellently prepared book invaluable.

new literature

Diesel Starting Batteries

are discussed in a specification bulletin published by C & D Batteries, Inc. These specifications include data on battery ratings, details of design, dimension and weights.

Manual On Modified "110" Engine

GM Detroit Diesel Division has made available a new Series 110 Operator's Manual covering engine units equipped with Roots blower. This manual, contains latest operating instructions, illustrated lubrication and preventive maintenance schedule and other subjects relative to the care of engines.

Remote Reading Gauges

by Jerguson Gage & Valve Co. are illustrated in the company's newly released catalog sheet. This new line of gauges is available with indicating scale inclined up for maximum visibility when mounted on low panels or inclined down for high installations.

Complete Line of Silencers as Built by Kittell

are described in a new 24-page catalog just released by the company. This publication describes in detail Kitteil industrial, mobile and marine silencers, including many new models, providing dimensions, design principles and application photographs.

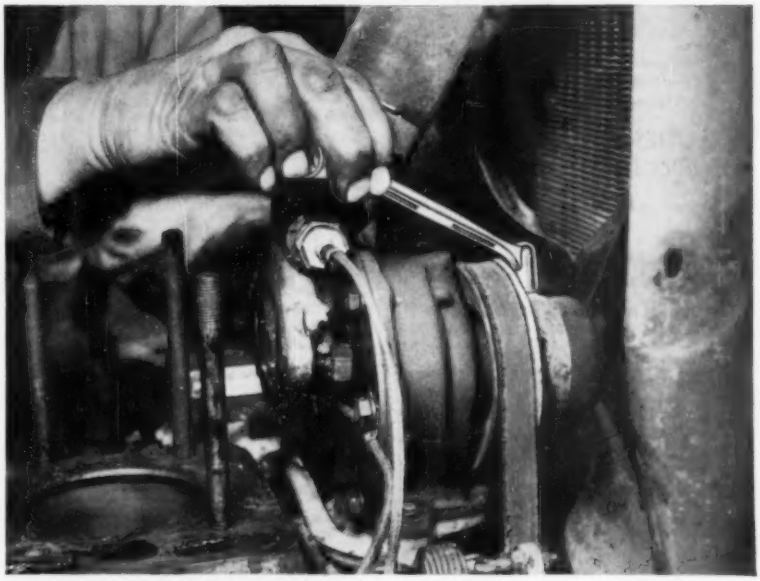
Steel Castings

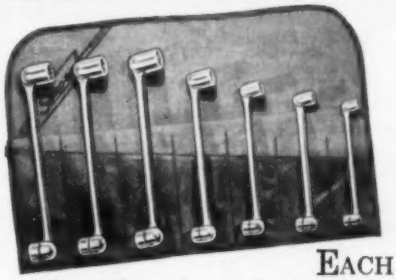
The second edition of the booklet "Stainless Castings" has been released by Allegheny Ludlum Steel. The 28-page booklet gives detailed information on corrosion-and-heat resisting stainless steel castings.

Torque Converter Drive And Its Advantages

for lift trucks are described in the new specifications on the Hystamatic Drive, now being made for Hyster Lift Trucks.

*Snap-on FLEX-HEAD WRENCHES —
SLIP into tight spots —
PIVOT for action





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EACH socket of a *Snap-on* Flex-Head pivots through an arc of over 180 degrees — making it a handy wrench for reaching universal flange bolts, pan cap screws and similar jobs. The wrench swings over and under obstructions — handles hard-to-get-at nuts, studs, bolts. A friction spring holds the desired socket angle. With the handle in a vertical position, the nut can be spun rapidly. Flex the handle over and you have maximum leverage for tightening or breaking loose.

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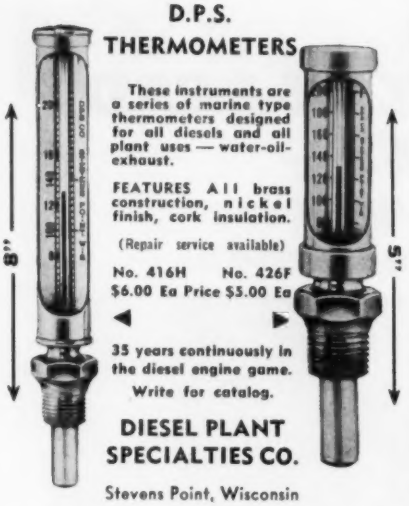

These instruments are a series of marine type thermometers designed for all diesels and all plant uses — water-oil-exhaust.

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new products

Fail-Safe Monitor

Development of a fail-safe voltage and/or frequency monitor, adjusted to usual military and commercial specifications or adaptable to special requirements, has been announced by Electric Regulator Corp. The monitor includes the Regohm regulator, a product of the same company.

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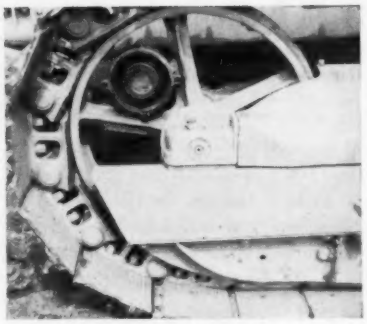

New Odometer Records Tractor Travel

Caterpillar Tractor Co. has designed a new type odometer to accurately record distances traveled by their tractors.

This new piece of equipment can be easily and inexpensively mounted on both spoke-type and disk-type idlers.

Giving excellent accuracy in the low speed ranges, the unit will register positive mileage in forward and reverse gears, provide 98% accuracy in the lower three gears and 90% accuracy in fourth gear. This device is inoperative in fifth gear.

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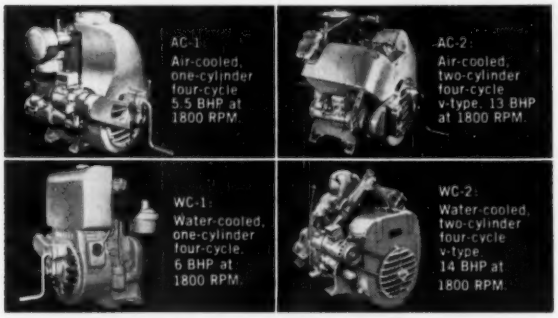
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AMERICAN MARC also manufactures Diesel generating plants from 3 to 10 KW (AC or DC, and industrial three-phase), Diesel pumping units from 4 to 1700 GPM, marine propulsion, refrigeration units and power-packages for other services. American MARC can adapt any of its Big 4 engines to fit every job requiring from 5 to 20 BHP.

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What Do You Know!

(*Answers to Questions on Page* 47)

1. Correct answer is "a". It is possible and often practical to burn liquid and gaseous fuel together in small industrial and automotive diesels. It is being done to gain the advantages discussed in the article on Page 32.

2. Correct answer is "b". Turbo rotor speed lags because of (1) inertia speed and (2) because it must wait for increased exhaust energy to accelerate. See Page 40.

3. Correct answers are "a & b". Both altitude and lower manifold density condition result in less weight of air trapped in the cylinder. To prevent smoking under these conditions the injection pump maximum fuel delivery should be limited. See article on Page 40.

4. Correct answer is "b". Low and/or high temperature engine operation plus dirt, dust and wear metals not removed by filters make it necessary to use special lube oils in LPG engines. See article on Page 46.

5. Correct answers are "b & c". Comparison of spot color with a special chart, plus checking location of materials in suspension in spot, show if oil is dirty and how dispersancy is holding up. See Page 48.

6. Tests show that the more viscous the fuel, the quicker thermal efficiency drops off with increasing load. See article on Page 50.

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new literature

New Catalog Of Small Diesels
has been issued by American M.A.R.C. Inc. This 30 page publication gives full data and specifications of the complete line of American M.A.R.C.-Hallet engines, and in addition contains information of interest concerning small diesels in general.

Small Air-Cooled Compressors
are offered by Gardner-Denver in a new 16-page bulletin showing their complete line of small air-cooled compressors for industrial, commercial and general use. Both one and two stage compressors are described, with working pressures from 85 to 175 psi.

Six Questions To Ask When Buying An Industrial Locomotive
is the title of the first of a series of publications to be made available by General Electric Co. as a guide for prospective purchasers of industrial haulage equipment. Sixteen pages with photographs and charts describe the GE line of diesel locomotives and answer questions that a buyer might ask.

Automatic Engine Starting Instructions
helpful to personnel assigned to operate, maintain or repair automatic starting installations, are listed in the newly revised "Instructions for Operating Automatic Starting Units."

Made available for GM Detroit Diesel Division, the manual is illustrated with wiring diagrams and photographs.

Alco Offers Comprehensive Spring Bulletin
on its production of hot and cold wound steel springs for diesels and associated equipment among other services. This two-color publication describes Alco's 80 years in the spring-producing industry. Also included is a description of the company's adaption of automation techniques in producing springs.

Bolting Problems
are discussed in a 40-page illustrated research report the U. S. Navy has made public. They have found that reduction in the shanks of steel bolts results in more desirable shock properties.

Industrial Power Units
and fan to flywheel engines are discussed in Detroit Diesels new illustrated brochure. Covered are horsepower ratings, dimensions and accessory information on single and multiple-engine models from 56 to 761 rated brake horsepower.

Features of New Cooling Towers
for industrial and air conditioning service are described in J. F. Pritchard's new bulletin 51.902 Rev. 4. Dimensions, engineering data and mechanical features are among the points covered in this literature.

Combustion-Testing Instruments
and those for air measurements are illustrated and described in a new bulletin made available to the industry by General Scientific Equipment Co. Gas pressure manometers, oil flow graduates and filter gauges are among the instruments covered.

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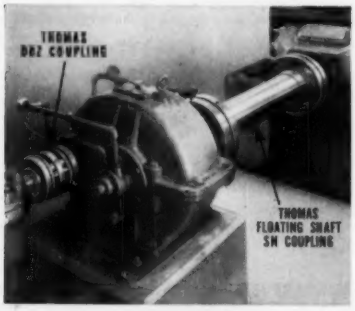

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They will protect your equipment and extend the life of your machines.

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4 Visual Inspection While in Operation
5 Original Balance for Life
6 No Lubrication
7 No Wearing Parts
8 No Maintenance

Write for Engineering Catalog 51A

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

new products

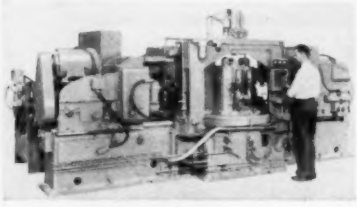
New Laboratory

In order to facilitate research, Armour Research Foundation of the Illinois Institute of Technology has created a new Combustion Laboratory.

New Gasket Kit For Roosa Master Pumps

A gasket kit for each of the six models of RoosaMaster Pumps has been put into production by Hartford Machine Screw Company.

There are six sets of these gaskets, each in a convenient kit and each individual kit contains all gaskets necessary to service the pump for which it is designed.



Diesel Con-Rods Mass Machined

A new unit for machining diesel connecting rods has been announced by Greenlee Bros. This three-way, four-station, horizontal, automatic indexing unit machines 84 rods per hour.

Fixtures are manually loaded with two connecting rods and are mounted on the index table located at the first station. Rods are then automatically clamped into position by a built-in, air-operated torque wrench.

Pre-machined centers in each of the rods are used for end-wise location in the fixture. Rods are then indexed from station to station by a hydraulically-operated gear and rack mechanism. At the second station, wrist pin holes are drilled and the cap-side of the crankshaft hole is bored.

Bolt bosses are milled square at the third station and at station four, pin holes are semi-finished reamed. A sawing operation separates the caps from the rods.

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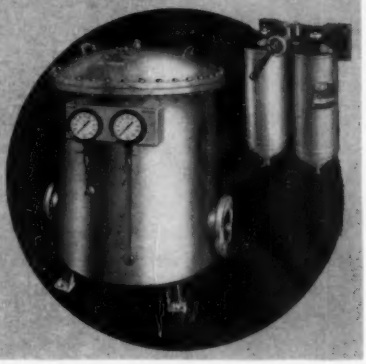

Fulflo — the first *full-flow* lube filter ever applied to a high horsepower diesel engine — provides micro-fine clarification of both fuel and lube, for *all types* of stationary engines, mobile equipment, and for bulk filtration. Fulflo is applicable to both the pressure and suction sides of fuel lines. Fulflo gives you lower maintenance and operating costs — plus longer engine life by eliminating clogged nozzles and reducing engine wear.

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Commercial Filters products include CFC (formerly Honan-Crane) Filters which employ a variety of filter media such as Cranite (Fuller's earth) for removal of soluble contaminants as well as abrasive particles. Inexpensive Michiana Filters, with "throw-away" or repackable elements, are also available.

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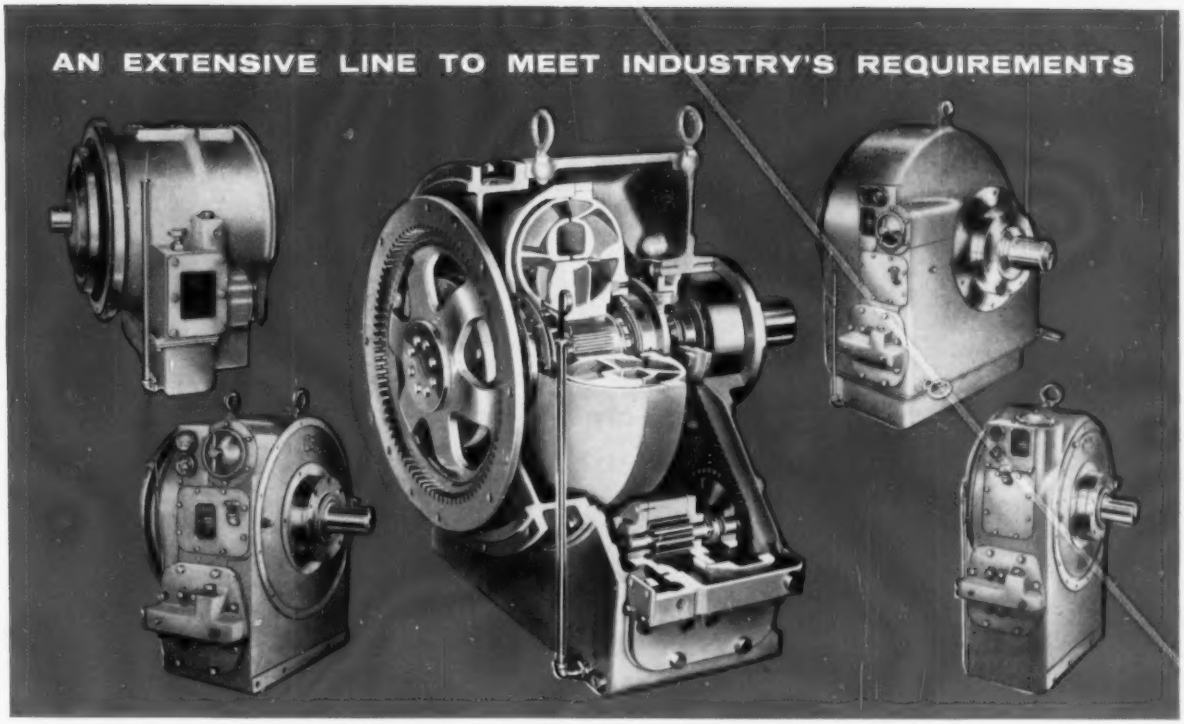

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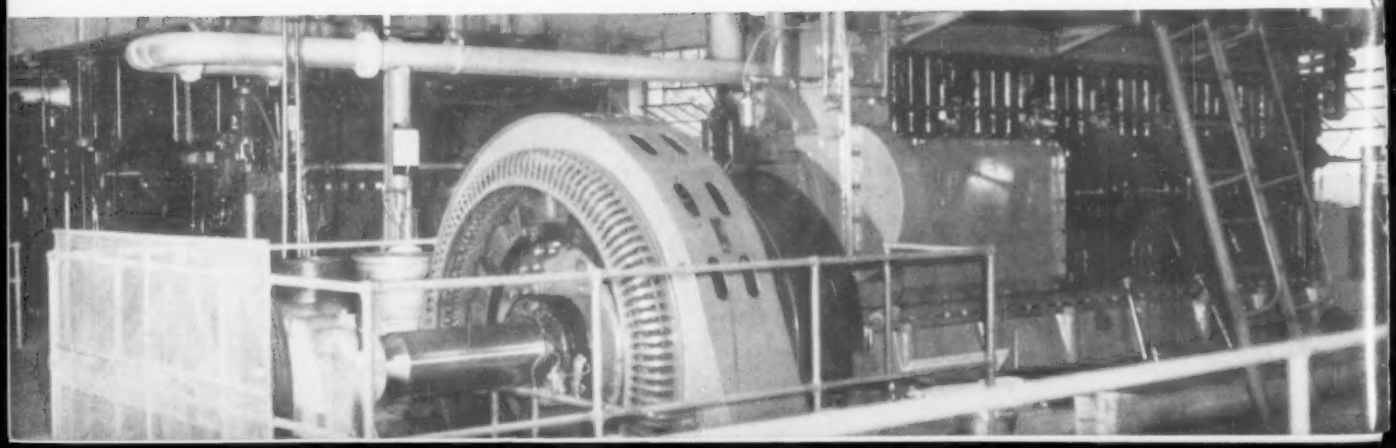
STANDARD OIL COMPANY
(Indiana)

STANDARD

John Acklestad, Aitkin plant superintendent, and Carl Klenner (left) Standard Oil industrial lubrication specialist check engine service record. Carl has been rendering technical service on lubrication problems at Standard Oil for eight years. He has a degree from the Michigan College of Mining and Technology and has completed the Standard Oil Sales Engineering School.

"As is" photo of piston removed from engine after 38,000 hours of service. Rings were free.

Quick facts about
STANODIESEL Oil M

- Keeps crankcase, pistons, cylinder walls clean.
- Combats deposit and wear problems imposed by use of economy fuels.
- Maintains film on difficult to lubricate areas and parts.
- Eliminates spark plug fouling in spark ignited gas engines and reduces combustion chamber ash and deposits in engines burning natural gas, LPG and liquid fuels.
- Eliminates fuel injector and pump sticking caused by deposits on injector barrel and plunger where fuel and lube oil commingle.